Appendix H
Economic Impact Assessment

Economic Assessment for the
Proposed
Little Darby National Wildlife Refuge

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Executive Summary

The U. S. Fish and Wildlife Service is the primary Federal agency responsible for conserving, protecting, and enhancing America's fish and wildlife resources and their habitats. The Service manages the National Wildlife Refuge system which administers a national network of lands and waters. The proposed action in this environmental assessment is to develop a Little Darby National Wildlife Refuge (NWR) to serve as one vehicle to restore, preserve, enhance, and protect the biodiversity of the upper Little Darby Creek watershed and mitigate human impacts to the Darby Creek watershed as a whole.

The proposal envisages two approaches to habitat protection, restoration and protection. Altered wetlands and grasslands would be restored through a voluntary purchase area. The area would be acquired in fee title by the Service and operated as a traditional national wildlife refuge. The current agricultural use of a Watershed Conservation Area would be preserved through the use of easements and similar agreements. The Watershed Conservation Area would prevent further degradation of the habitat by encouraging best management practices and slowing commercial development. Four action alternatives and a "no action" alternative are considered in this assessment.

The economic study area of Madison and Union counties is a region in transition. Historically, it has been a farming area specializing in corn, soybeans, and wheat. Madison is often in the top ten corn or soybean producing counties in Ohio. More recently, however, the trend is away from agriculture toward suburban development. Columbus has expanded bringing work sites within easy commuting distance. Union county, itself, has developed a significant industry bringing manufacturing jobs into the rural landscape. In 1990, 40 percent of Madison county workers worked outside of the county. As population growth in the study area has averaged one percent per year largely from in-migration, this trend to commuting is likely to continue. The no action alternative reflects anticipated residential development in the proposed refuge area.

Standard input/output techniques were used to estimate the regional economic impacts per acre of agricultural, residential, and refuge land uses. Projections of population growth in the study area and information about preferred areas for rural residential development lead to estimates of the area each type of land use would cover with and without Little Darby NWR. These projections are based on the 1994 Comprehensive Plan (**CP**) for Madison County. Madison County is revising the CP and has adopted a Farmland Preservation Plan (**FPP**). Since it is not clear at this time what the final provisions of the CP and FPP will be, anticipated future conditions under both the 1994 CP and the revised CP (including the FPP) will be used to estimate the regional economic impacts of refuge development.

The analysis showed that when it is fully implemented in 30 years under the 1994 CP scenario, the voluntary purchase area of the refuge and its associated operations, recreation and cooperative agriculture would provide 73 percent (Exhibit E-2) as many jobs and about 65 percent as much spending as the existing farmland (Exhibit E-1). Services industries would increase output with a refuge

while agricultural services and trade would experience a decrease in spending. Similarly, under the **FPP** scenario, refuge operations, recreation and agriculture would provide about 68 percent as many jobs and 61 percent as much spending as existing farmland. The trade-offs between agriculture and wildlife habitat are overshadowed by the impact of residential development displaced by the refuge. Under the 1994 **CP** scenario, the largest refuge voluntary purchase area considered may displace 74 agricultural jobs but it will create 54 jobs related to refuge operations and recreation. Residential development of the same area would have created 503 jobs. Residential development would greatly change the character of the study area as well as its economy.

Exhibits E-1 and E-2 summarize the regional impact findings under the 1994 **CP** scenario. Exhibits E-1a and E-2a summarize the findings under the **FPP** scenario. The major objective of the **FPP** is to protect agricultural lands but under the current provisions of the FPP development is still possible. It is not known with any certainty how much land may actually be developed. For the purposes of this analysis, it is conservatively assumed that future development will be similar to what has actually been constructed in the area during the past nine years (1991-99) according to the Madison County Building and Zoning Department.

The tables for each scenario show the difference in spending or the number of jobs in the study area counties between the no action alternative and the alternative named at the top of the column. The alternatives are described in detail in the environmental assessment. These are approximate estimates which show the scale of impacts that may be expected.

Exhibit E-1. 1994 CP: Summary of Spending Impacts of Each Alternative, 2030 ($1998, thousands)				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Refuge				
Recreation and Agriculture	2,903	2,669	2,440	2465
Operations	800	800	800	800
Refuge Total	3,703	3,469	3,240	3265
Agriculture				
Voluntary Purchase Area	(5,866)	(5,207)	(4,871)	(4,804)
Watershed Conservation Area	253	276	288	167
Agriculture Total	(5,613)	(4,931)	(4,583)	(4,271)
Residential				
Voluntary Purchase Area	(28,877)	(33,616)	(27,701)	(30,897)
Watershed Conservation Area	(17,065)	(18,663)	(19,434)	(11,260)
Residential Total	(45,942)	(52,279)	(47,135)	(42,157)

Note: Refuge recreation and operations only occur in the voluntary purchase area.
source: USFWS Division of Economics analysis[1]

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[1]Estimates derived by the author's using information sources cited elsewhere in the document are referenced as **USFWS Division of Economics analysis.**

Exhibit E-1a. FPP: Summary of Spending Impacts of Each Alternative, 2030 ($1998, thousands)				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Refuge				
Recreation and Agriculture	2,915	2,669	2,441	2,465
Operations	800	800	800	800
Refuge Total	3,715	3,469	3,241	3,265
Agriculture				
Voluntary Purchase Area	(6,119)	(5,511)	(5,088)	(5,074)
Watershed Conservation Area	NA	159	159	93
Agriculture Total	(6,119)	(5,352)	(4,929)	(4,981)
Residential				
Voluntary Purchase Area	(12,987)	(13,079)	(13,061)	(12,712)
Watershed Conservation Area	NA	(10,691)	(10,691)	(6,301)
Residential Total	(12,987)	(23,770)	(23,752)	(19,013)

Note: Refuge recreation and operations only occur in the voluntary purchase area.
source: USFWS Division of Economics analysis

Exhibit E-2. 1994 CP: Summary of Job Impacts of Each Alternative, 2030 (Number of jobs)				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Refuge				
Recreation and Agriculture	32	29	27	29
Operations	22	22	22	22
Refuge Total	54	51	49	51
Agriculture				
Voluntary Purchase Area	(74)	(66)	(59)	(64)
Watershed Conservation Area	NA	3	4	2
Agriculture Total	(74)	(63)	(55)	(62)
Residential				
Voluntary Purchase Area	(503)	(585)	(482)	(548)
Watershed Conservation Area	NA	(325)	(338)	(210)
Residential Total	(503)	(910)	(820)	(758)

Note: Refuge recreation and operations only occur in the voluntary purchase area.
source: USFWS Division of Economics analysis

Although it would increase overall economic activity, residential development also imposes more costs on the community. Among the largest of these is the cost of educating new resident children. Anticipated taxes on new housing barely cover the cost of schooling leaving little to help with other public services or infrastructure. Revenue sharing from Little Darby NWR, on the other hand, compares favorably with the Current Agricultural Use Value tax proceeds from agricultural land. Plus, refuges place few demands on county services.

All of the changes discussed will be phased in over 30 years. There will be ample time for residents to adapt to the changing environment. Ironically, if the project is successful, residents will notice that other areas of the region are changing dramatically while the project area remains the same or turns back into natural vegetation. Residential development that would have occurred in the area will be displaced to other areas possibly also in the two study area counties. The changes predicted are within the normal variation for agricultural and recreational industries and are likely to be imperceptible against the broader trends in the national economy.

Exhibit E-2a. FPP: Summary of Job Impacts of Each Alternative, 2030 (Number of jobs)				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Refuge				
Recreation and Agriculture	32	29	27	29
Operations	22	22	22	22
Refuge Total	55	51	49	51
Agriculture				
Voluntary Purchase Area	(81)	(68)	(62)	(68)
Watershed Conservation Area	NA	2	3	1
Agriculture Total	(81)	(66)	(59)	(67)
Residential				
Voluntary Purchase Area	(226)	(228)	(227)	(237)
Watershed Conservation Area	NA	(199)	(199)	(117)
Residential Total	(226)	(427)	(426)	(354)

Note: Refuge recreation and operations only occur in the voluntary purchase area.
source: USFWS Division of Economics analysis

Regional impacts are important for local interest groups. On a national scale, however, they represent only shifts in spending and income from one area of the country to another. Recreational spending, for example, would have occurred elsewhere if not at Little Darby. To evaluate the effect of the project on national well-being, we need to estimate the benefits or "net economic value" produced by each alternative. All of the refuge alternatives produce national benefits of at least $1.5 million annually. Conversion of land to refuge use provides more benefits than any of the other options by contributing to the recreational opportunities in central Ohio. In addition to the recreational benefits, unquantified ecosystem and endangered species benefits could double the estimated level of benefits.

The project area is a small proportion of farmland in the Columbus area. The largest acquisition alternative would encompass 5.2 percent of the farmland area of the two project area counties when it is complete. This is slightly over half the loss of farmland (17,000 acres) that has occurred in Madison and Union counties from 1982 to 1997. Project activities will have no effect on agricultural land values and little effect on the value of land for other uses. The refuge does not change landowners' economic opportunities significantly.

Chapter 1. Overview of the Study Area

This section provides an overview of the regional economy and gives the context for the impact analysis. The original study area for the project encompassed most of the watershed for Little Darby Creek in Madison, Clark, Champaign and Union counties, Ohio. Clark county contained only a small portion of the watershed and none of the alternatives under consideration include any land in Clark or Champaign county. So for this economic analysis the study area is Madison and Union counties.

Madison county is within the Columbus Metropolitan Statistical Area. The landscape of level plains and low-lying hills is largely agricultural. Cleared and drained in the last century, the area has been a major producer of corn and soybeans. Road improvements, changes in work site locations, and changes in attitudes toward commuting have opened the area to suburban development. Employment has shifted from agriculture to manufacturing and service industries. Trends suggest this shift will continue in the future altering the present land uses toward more residential and commercial development.

Population

The Columbus area population has been growing faster than Ohio as a whole. The study area counties' population growth rate lagged behind Columbus in the 1980's, 0.68 vs. 1.03 percent per year, but has surpassed it in the period from 1990 to 1998, 2.03 vs. 1.11 percent per year. The two study area counties are projected to continue their rapid growth in the future. Both the study area counties and Columbus populations are expected to grow much faster than the state population in the coming decades.

Exhibit 1-1. Population of the Study Area Counties, Region, and State,1980-2015					
Region	**1980**	**1990**	**1998**	**2015 proj**	**2030 proj**
Madison County	33,004	37,068	41,576	48,950	57,300
Union County	29,536	31,969	39,494	49,530	62,350
Study Area Counties	62,540	69,037	81,070	98,480	119,650
Annual Growth Rate		0.68%	2.03%	1.15%	1.31%
Columbus MSA	1,214,000	1,345,000	1,470,000	1,723,000	1,985,000
Annual Growth Rate		1.03%	1.11%	0.94%	0.95%
State of Ohio	10.8 M	10.8 M	11.2 M	12.1 M	12.9 M
Annual Growth Rate		0.05%	0.41%	0.43%	0.43%
Source: Ohio Dept of Development, Office of Strategic Research, *County Profiles* and U.S. Bureau of the Census, *County and City Data Book, 1988*. Population projection to 2030 based on growth continuing at the 1998-2015 rate through the period.					

The population of the townships in the Little Darby Creek watershed grew faster than the rest of the county during the 1990's. Much of this development is in Somerford which increased its population more than 20 percent from 1990 to 1998.

Exhibit 1-2. Population Growth in Northern Madison County, 1990-1998				
	1990	**1998**	**Difference**	**Annual Growth Rate**
Refuge Area Townships	10,089	11,616	1,527	1.78%
Rest of Madison County	26,979	29,960	2,981	1.32%
Source: Ohio Department of Development, Estimates of Ohio's Population by Governmental Unit, 1999.				
Refuge area townships are Pike, Darby, Canaan, Monroe, Somerford, and Deer Creek				

Industries

Major employers in the study area are manufacturing, services, trade, and government. Exhibit 1-3 shows the manufacturing sector generates the largest proportion of output and employment income. The dominance of the manufacturing sector has increased since these statistics were estimated as the full impact of new automotive investments in Union county are not yet reflected in the data. These data are part of the basis for the input/output model used to predict future impacts of the refuge.

Exhibit 1-3. Sectors in the Project Area Counties, 1994			
Industry	**Output**	**Employment**	**Employment Compensation**
	($M, 1994)	(Jobs)	($M, 1994)
Agriculture	139.4	2,575	9.3
Mining	5.3	57	1.5
Construction	184.1	2,489	56.4
Manufacturing	4,981.6	13,994.0	792.5
Utilities	152.0	1542	33.0
Trade	279.7	6,283	105.0
Finance	208.0	876	13.3
Services	289.2	6,540	124.4
Government	150.6	5,162	146.5
Other	(3.7)	183	1.1
Total	6,386.2	39,701	1,282.8
Source: IMPLAN Summary Data, 1994			

The pattern of employment in the study area counties is quite different from the State of Ohio and each county has a different mix of employment[2]. Manufacturing is dominant in Union county where almost

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[2]Agricultural employment was not included in the 2020 projections so it is not included in Exhibit 1-4 to permit direct comparisons. Farm employment is about 5.6 percent of total employment

half the jobs covered by unemployment insurance are in manufacturing. The presence of the Madison Correctional Facility, state, and university facilities in Madison county is evident in the high rate of government employment. Relatively high construction employment may indicate development activity in Madison county. The project area counties have considerably higher proportions of manufacturing and government employment than the state as a whole and a lower proportion of trade and service jobs. Finance and some services may be provided in nearby Columbus.

Exhibit 1-4. Percentage of Employment by Industry, 1997				
	Madison	Union	Project Area	Ohio
Mining	0.0	0.0	0.0	0.3
Construction	7.5	4.8	5.8	5.2
Manufacturing	19.8	48.0	37.0	17.4
Utilities	2.6	4.4	3.7	4.4
Trade	20.7	13.3	16.2	23.4
Finance	4.7	0.0	1.8	7.3
Services	24.7	18.5	20.9	29.7
Government	19.8	11.1	14.5	12.4
Source: U.S. Dept of Commerce, Bureau of Economic Analysis, REIS data				

Forecasts of Ohio employment in 2020 shown in table 1-5 reflect the national trend away from manufacturing and into service employment. Union county is expected to buck this trend and continue its strong growth in manufacturing. The proportion of workers in construction continues to grow in Madison county.

Exhibit 1-5. Percentage of Employment by Industry, 2020				
	Madison	Union	Project Area	Ohio
Mining	0.0	0.4	0.3	0.4
Construction	9.8	2.9	5.2	4.6
Manufacturing	11.4	53.3	39.2	17.4
Utilities	4.1	4.5	4.4	4.4
Trade	22.0	13.1	16.1	22.8
Finance	4.1	2.5	3.0	6.8
Services	25.2	15.2	18.5	31.7
Government	23.6	8.2	13.4	12.0
Source: Ohio Department of Development, Office of Strategic Research, Ohio County Profiles from BEA data				

in the study area. Another 1.8 percent of employees are in agriculture service industries (U.S. Department of Commerce, Bureau of Economic Analysis 1997).

Agriculture

Agriculture is a major land use in the project area. Roughly 88 percent of the land area in the project area counties is in farms. The dominant crops are corn, soybeans, and wheat (U.S. Department of Agriculture, 1997 Census of Agriculture). Union county has a large animal industry. Its primary output is hogs and pigs with $9.4 million receipts in 1997. Dairy is the largest component of Madison county animal production ($3.4 million) (Ohio Department of Agriculture, 1998 Annual Report and Statistics).

Exhibit 1-6 summarizes some important agricultural statistics for the study area. Madison county farms are larger, on average, than farms in Union county. The average size farm for the state of Ohio is 186 acres. Madison county farmers are also less likely to work extensively off the farm. Only 36 percent of Madison county farm operators worked off-farm for 200 or more days in 1997. A farm operator is the individual most responsible for farming decisions. The definition does not include farmers' spouses or other family members. Although more than one third of Madison county farmers worked extensively off the farm, this rate of off-farm work is one of the lowest among Ohio counties. The state as a whole experienced 43 percent of farmers working more than 200 days off-farm (U.S. Department of Agriculture, 1997 Census of Agriculture).

In 1998, corn for grain yields exceeded the state average in both counties. Madison was the 5th largest corn producing county in the state. Soybean yields were near the state average in Madison, in 1998, but below the average in Union. Madison ranked 8th in Ohio soybean production (Ohio Department of Agriculture, 1998 Annual Report and Statistics). Madison has an extremely low rate of CRP participation while Union has more than double the amount of land in CRP.

More than half the land in the study area counties is leased. Statewide the average percentage of leased farmland is 47 percent (U.S. Department of Agriculture, 1997 Census of Agriculture). Working leased land gives the farmer somewhat less control over his business. Ultimately, the landowner controls the use of the land and makes the decision whether it will be farmed, idled, or converted to some other use.

Exhibit 1-6. Agricultural Statistics for the Project Area Counties, 1998

	Madison	Union	Madison/Union County Totals	Ohio
Number of Farms	680	940	1,620	80,000
Land in Farms (ac)	268,000	217,000	485,000	14,900,000
Average Farm Size (ac)	394	231	275	186
1997 Cash Receipts ($ million)	$77.1	$74.3	$151.4	$4,684.0
CRP Participation (2000, ac)	3,694	7,140	10,834	297,618 (approx.)
CRP - Project Area (approx. Ac.; NRCS data, 2000)	600	300	900	
Leased Land (1997, percent)	59	55	----	47
Operators working 200+ days off-farm (1997, percent)	36	44	----	43
Production				
Corn for Grain (million bu)	12.3	6.7	19	470.9
Soybean (million bu)	5.1	4.1	9.2	193.2
Wheat (million bu)	1.1	1.4	2.5	74.2

Source: Ohio Department of Agriculture, 1998 Annual Report and Agricultural Statistics; Natural Resource Conservation Service; U.S. Department of Agriculture, Census of Agriculture, 1997 and Ohio State University Extension, *1999 County Profiles*.

The Changing Pattern of Employment Locations

As in many rural areas, the character of the study area counties has been changing in recent years. Highway improvements and expansion of Columbus' employment opportunities to the I-70 and I-270 corridor bring much of the study area within a half hour commuting distance to jobs in Franklin county. In 1960, only 29 percent of residents in the three study area counties commuted to work outside the three counties. By 1990, 47 percent were leaving the study area counties to go to work. While some of this change has been a shift of residents from on-farm or local work to more distant work sites, there has been a net in-migration to the area of about 1,200 people per year in the 1990's. These people are part of a nationwide pattern of families seeking rural amenities at home while maintaining urban jobs (Cromartie and Nord). Given the expected population trends described above and the planned development of work sites, the suburbanization of the study area near Columbus is likely to continue.

Exhibit 1-7. Number of Union and Madison County Residents Working...

	1960	1970	1980	1990
Within the 2 counties	11,775	12,192	15,260	17,478
Outside of the 2 counties	4,746	7,158	9,920	13,618
Percent Out of the counties	29%	37%	39%	44%

Source: U.S. Department of Commerce, Bureau of Economic Analysis, REIS 1969-1995, Journey to Work database.

More Madison county residents work in Franklin county than work in Madison according to the 1990 census. In many industries workers earn higher wages in Franklin county. Construction workers, for example, earn $23,200 in Franklin county versus $17,100 in Madison. More than twice as many construction workers work in Franklin as in Madison. Manufacturing, trade, and utilities workers have similar pay and employment differentials. Although Franklin county contains the state capitol, the London Correctional Institution, local schools, and other state and local government facilities, employ more Madison County residents. Service workers, self-employed people, and farm workers are paid less than employees in other sectors and are more likely to stay within their home county.

Exhibit 1-8. Employment of Madison County Residents by Location and Industry, 1990				
	Number of Workers		Average Wages	
Industry	Live and Work in Madison	Live in Madison, Work in Franklin	Madison	Franklin
Utilities	78	664	25,443	26,537
Manufacturing	1,205	1,400	19,179	26,281
Federal Government	118	112	26,967	25,358
Construction	176	394	17,060	23,237
State and Local Government	1,280	837	18,890	22,602
Finance	175	464	28,521	21,046
Services	1,293	1,234	16,219	16,992
Trade	1,437	1,756	12,599	16,312
Self-Employed	1,003	233	26,092	16,223
Agricultural Services	42	46	15,359	15,428
Farming	174	31	12,935	12,129
Total	6,981	7,171		
Source: U.S. Department of Commerce, Bureau of Economic Analysis, REIS 1969-1995, Journey to Work database.				

Recreation

Public recreational land is extremely limited in the project area counties. Madison county contains 183 acre Madison Lake State Park (108 of which is lake) and the Gwynne Conservation Area, a 40+ acre site owned by OSU. Stream easements provide fishing access to some waters. Union county has several city parks. Presently, Ohio ranks 45th nationally in the total amount of Federal and State land.

Summary

The project site and surrounding study area is a region in transition. Historically, it has been a farming area specializing in corn, soybeans, and wheat. The larger trend, however, is away from agriculture toward suburban development. Columbus has expanded bringing work sites within easy commuting distance. Union county, itself, has developed a significant industry bringing manufacturing jobs into the rural landscape. Forty-four percent of workers in the two project area counties leave the area to go to work. The baseline scenario reflects anticipated growth as a rural residential area.

Chapter 2. Regional Economic Impacts of the Little Darby NWR

This chapter outlines the conceptual framework and methods of this economic analysis. To assess the economic effects of the refuge, we compare what the future regional economy would be like without the refuge to what it would be like with it. This chapter considers changes in the patterns of development, spending, and employment in the region. The next chapter considers impacts to the national economy.

In this chapter, we use a regional economic modeling technique known as Input/Output Analysis to characterize the future state of the economy with and without the refuge. Each action alternative is compared to the No Action alternative 15 years and 30 years in the future. The key land uses in the project area are agricultural, residential, and refuge. The input/output analysis shows how each affects the regional economy differently. The different refuge alternatives result in different impacts on the regional economy by altering the pattern of land uses.

Concept and Methods

The question for economic assessments is what is the difference between the future state of the world with the action and without it. If there is no change in the size or nature of the economy from taking action, there is no economic effect. The comparison is always between a baseline of what is expected without the project (the No Action alternative, Number 5) for both the 1994 Madison County CP and the 1999 Madison County FPP scenarios and what is expected with it. A key assumption in this with/without analysis is the baseline for comparison.

Economics is the study of the allocation of resources to meet human needs. People derive benefits from goods traded in markets, provided by the government, and provided by the ecosystem. For market goods some of the benefits are passed on to the provider of the good as the price for using the good. Producers decide how much to make based on the price they receive. Goods provided by the government are paid for by taxes. Legislatures and administrators decide on the appropriate level of provision. In general, governments provide a good when the private market fails to communicate the appropriate signals for its provision.

Open space, for example, is something many people find beneficial yet there are few effective ways for them to organize and offer to purchase it. As landowners cannot respond to offers they don't receive, they sell to developers whose offers reflect only the value of the land for development. Government action is one means to organize people who benefit from open space and provide the resources to preserve it for society. Services provided by the ecosystem are provided without human intervention. One role of government is to ensure that enough natural landscape remains to provide adequate ecosystem services for the society and to protect those natural resources held in trust by the government for the public's benefit.

Anything that people benefit from contributes to their well-being. The idealized decision-maker chooses policies and actions that maximize all individuals' happiness by providing the frameworks for markets to operate, allocating tax revenue to provide public goods, and enforcing environmental

policies that protect the ecosystem. The decision about undertaking a project ideally rests on a consideration of how the project will affect well-being through any of these channels while protecting trust resources.

Although they often seem related, well-being isn't about spending money. The exchange of goods for money is really an exchange of money for some set of gross benefits you expect to derive from the good. The difference, between the benefits you expect to receive from what you acquire and the money you pay to acquire it, is termed the "net economic value," or "consumer surplus." For government provided goods, the consumer surplus is the difference between the benefits from the service provided and the incremental taxes needed to provide it. For ecosystem services, all of the benefits are consumer surplus. The decision-maker seeks to find the project option that maximizes all of these sources of benefits at the lowest cost to society. A welfare analysis, like that presented in Chapter 3, evaluates alternatives' effects on national well-being to aid in this decision.

Local leaders, however, may have other concerns. They may believe their region would be better off with more economic activity or a greater population. If there is high unemployment or excess capacity, they may seek new jobs and industries to relocate to the region. Regional economic analysis shows the changes in output, income, and jobs by creating a model of the regional economy. The model economy is then changed as we expect each alternative will change the real economy. The changes in output, income and jobs in the model economy show the expected impact of the alternative.

The most common type of model now in use is input/output analysis (I/O). Input/output analysis uses business's purchase information to discover the linkages among industries in the economy. By manipulating a matrix of transactions it is possible to follow all of the effects of a purchase as they flow through the economy. A purchase of seed, for example, flows back to wholesalers, truckers, seed farmers, and agricultural chemical manufacturers.

I/O analysis is very powerful but also limited. It can only look up the supply chain, not down. It can consider the benefits of additional land devoted to wheat on agricultural chemical suppliers but ignores the possible downstream effects on flour mills. I/O is also a static model. Industries in the model do not change their production methods in response to changes in the business environment. For this study, we used a 1994 data set as our model of the economy in all of the regional analyses[3]. Considering the past 30 years, substantial changes in the interactions of industries are possible. Recall the size of the computer industry in 1969. These changes are ignored in I/O analysis. I/O models also ignore individuals' ability to adapt to changing situations. An I/O analysis of the introduction of automobiles might have predicted great unemployment for blacksmiths but it would not have foreseen the conversion of blacksmith shops into automobile service stations. Because of this lack of flexibility, economists believe I/O results represent more severe long term impacts than will actually occur.

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[3]A 1997 data set is now available. Given the uncertainty of other parameters in the analysis and the small differences in industry structure that occur over three years, updating the model at this time was not considered worth the cost. A 1998 data set will be available shortly.

Baseline - No Action Alternative 5

As a basis for comparison, we need to define what we think the future of the study area will be if no action is taken by the Fish and Wildlife Service. One of the motivating factors for establishing Little Darby NWR is increasing development in the project area and counties. Just as the landscape has changed over the past 20 years, it can be expected to continue to change over the next 30 years. So the basis for comparison is not the status quo now but the anticipated landscape during the study period. The population of the project area counties is expected to grow by 21.5 percent from 1998 to 2015. This analysis will look at snapshots of the refuge and its impacts 15 years after inception (2015) and 30 years after inception (2030). We assume land uses will remain as they are now except that residential development and refuge activities, along with their related infrastructure, will displace other land uses. Positing new industrial development or other large scale changes is uncertain and confuses the effect of the refuge with other possibilities.

In 1994, Madison county developed a land use plan to facilitate thinking about appropriate locations for different types of future development. The 1994 Comprehensive Plan (**CP**) for Madison County (Lockwood, et al.) identifies corridors for future residential development. The plan shows the portions of the refuge project area that are agricultural now which are suitable to become residential land in the future. Suitability depends on slope, flooding possibilities, and soil characteristics. The No Action scenario anticipates conversion of some of this farmland to housing. The refuge alternatives anticipate this farmland becoming part of the refuge. The Comprehensive Land Use Plan is currently being revised. Information from the new revision was not available for this report. A Farmland Preservation Plan (**FPP**) has been adopted by Madison County as a component of the revised **CP**. Farmland protection against conversion to other uses is the primary objective of the plan. While some conversion to non-agricultural uses is possible, it is anticipated that the conversion rate under the **FPP** would be considerably less than under the 1994 **CP**.

Analyzing Regional Economic Impacts

Any change in land use alters the contribution of a parcel of land to the economy. A corn field, for example, yields a commercial product that earns income for the farmer and requires inputs from agricultural chemical and farm equipment dealers. Residential areas provide an important component for life, housing. Most residents earn income by selling their labor services away from the home. Residents spend their income at retail and grocery stores rather than agricultural supply dealers. If land is in housing rather than agriculture, resources will flow through different channels and affect different industries.

This analysis considers the impact of using land one way rather than another on an acre by acre basis. Each alternative and each of the two land use scenarios represent a different pattern of land use. Comparing the regional economic activity under the No Action alternative with the refuge alternatives shows the impact of the refuge alternative. For each land use (corn, soybeans, wheat, housing, wildlife refuge), the economic flows from one acre are estimated. Multiplying these estimates by the number of acres in that land use, we can see how the economy changes as land uses change. Comparing the

pattern of land use under the No Action alternative for each scenario with the pattern for each action alternative shows the impact of the action.

Regional Impacts of Agriculture

Agriculture uses 86 percent of the land area of the two project area counties. Major crops are corn, soybeans, and wheat. Crop budgets show the inputs necessary to raise an acre of grain. Exhibit 2-1 shows the Ohio State University Extension *Ohio Enterprise Budgets, April 1999* which were used to show the inputs used in corn, soybeans, and wheat production. The costs are based on state-wide averages which in turn are based on county-level surveys (while some study area costs are higher or lower than those shown in the enterprise budgets, overall these averages are fairly good approximations to actual Madison and Union County crop production expenditures. Personal communication, OSU Extension). The yield and receipt information are also based on state-wide averages. The yields shown in Exhibit 2-1 are based on a five-year average (1995-99). Recent yields for Madison and Union County along with state-wide averages are shown in Exhibit 2-1a. Exhibit 2-1b shows recent crop price information. Budget details appear in Appendix A. The amount spent for each input was assigned to the appropriate industry in the input/output model to make the link from each crop to the supporting regional economy. Profits and returns to labor, risk, land, and management were considered earned by the household and assigned to the household purchasing sector. Profits, or producer surplus, is a measure of the national economic benefits of the activity. Exhibit 2-1 shows total spending for all three crops exceeds the total budgeted costs of production. The Labor, Land, and Management Charge is budgeted at the normal rate of return

Exhibit 2-1. Crop Budgets, Costs of Production per Acre			
	Corn **(No Till)**	**Soybean** **(No Till)**	**Wheat**
Bushels per Acre	130	40	60
Fertilizer	$59	$23	$37
Seed	31	22	24
Chemicals	32	23	7
Fuel, Oil, Grease	8	8	9
Drying	13	---	---
Repairs	5	5	6
Miscellaneous	13	13	13
Machinery & Equipment	41	41	47
Total Allocated Costs	$202	$135	$143
Labor, Land, & Management charge	121	109	107
Total Cost	$323	$244	$250
Receipts	$267	$182	$135
Producer Surplus	($56)	($63)	($115)
source: Ohio State University Extension, *Ohio Enterprise Budgets, April* 1999.			

Exhibit 2-1a. Crop Production Data, Study Area Counties (bushels per acre)			
Crop	Madison County	Union County	Ohio State Average
Corn:			
Yield 1999	109.3	146.4	126.0
Yield 5-year average.	128.1	126.7	127.3
Soybeans:			
Yield 1999	27.7	37.4	36.0
Yield 5-year average	38.4	36.3	39.4
Wheat:			
Yield 1999	73.3	69.6	70.0
Yield 5-year average	60.4	56.1	58.5
source: U.S. Department of Agriculture, National Agricultural Statistics Service. *Published Estimates Database,* July 2000.			

Exhibit 2-1b. Ohio Crop Prices, 1999 and 1995-99 Average (1999 $ per bushel)			
	Corn	Soybeans	Wheat
1999	$1.94	$4.76	$2.05
1995-99 Average	$2.63	$6.37	$3.25
source: Ohio State University, *June Crop Outlook*. June 13, 2000.			

for the crop so the shortfall shows farmers are earning less than normal returns at current prices. Producer surplus is therefore negative. In the long run, this situation is untenable as farmers and landowners can find more profitable uses for their investments. In this analysis we are interested in long run results. So the budget for inputs was used and the receipts were ignored[4]. In the long run, farmers

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[4]Federal agricultural programs affect commodity prices and income. Budgets do not include State or Federal Subsidies payments. These programs are irrelevant to this analysis for two reasons.

should break even at average levels of inputs.

The budgets in Exhibit 2-1 were used as data for an I/O model. Exhibit 2-2 summarizes the results of the input/output analysis for one acre of land in each land use. The total impact represents the effects of direct, indirect, and induced spending as money flows through the economy. Output is the total production of industries in the study area counties attributable to one acre of each activity. Many of the inputs to agriculture come from outside the study area so money paid for them does not circulate long in the local economy. The impact on regional output per acre is little more than the original spending. Personal Income is wages and proprietors' income attributable to the spending. It is related to new jobs attributable to that land use. Every thousand acres in agricultural production generates 2.3 to 3.5 jobs. The input/output software used in this study uses the term "jobs" to refer to the number of positions, rather than the number of full-time equivalent workers. So a job may be less than full time. Impacts of agricultural land are largely focused on the fertilizer and farm machinery sectors.

Exhibit 2-2. Estimated Economic Impact per Acre on the Project Area Counties (1998 $/ac).

| | Agriculture | | | Residential | Refuge | |
	Corn	Soybeans	Wheat	Development	Recreation	Agriculture
Total Impact on:						
Output	$341	248	212	20,046	68	341
Personal Income	$96	75	62	6,644	24	96
Employment (per thousand ac)	3.55	2.99	2.34	319.89	0.90	3.55
Impact on the Output of Selected Industries ($)						
Fertilizer	$80	31	34	0	0	80
Farm Machinery	$36	36	41	0	0	36
Other Manufacturing	$18	17	16	755	5	18
Trade	$49	46	33	5,460	18	49
Services	$43	39	27	5,276	36	43

Regional Impacts of Residential Development

Residential development irreversibly commits land to housing. Housing provides the physical basis for household consumption. Like farm purchases, household purchases contribute revenue to local stores and generate economic activity. The median income in Madison county was $33,476 in 1993. This amount equals $36,739 in 1998 dollars. The **1994 CP** suggests rural housing lots should be from 1 to 20 acres. Assume the average lot size will be 2 acres, then the income per acre of residential development is $18,369. It is also assumed that under the FPP, average lot size will also be two acres.

For this analysis, this level of income was added to the local economy using the pattern of spending of the average U.S. household. We assumed that all of this spending occurs in the two county area.

First, the programs are scheduled to be phased out over the next 10 years under current law. So they will not exist 15 or 30 years from now when our snapshots occur. Second, we assume normal returns so all crop prices are irrelevant.

Obviously, a substantial portion occurs in other areas. Our assumption will tend to overstate the impact of displaced residential development on the project area. To the extent workers work outside the study area their earnings represent an export industry which generates new jobs and economic activity in the community.

There is anecdotal evidence that National Wildlife Refuges are a desirable amenity for residential developments. We were unable to quantify either the increase in land sales or the increase in land prices that might result from a shift in demand induced by Little Darby NWR. Generally, open space in close proximity to metropolitan areas is attractive for development.

Spending from a residential area is almost 60 times as large as spending for the same area in crop production. The impacts are similarly scaled up. In the project area, much that a household consumes is imported so multipliers are small. Spending of $18,369 yields output gains of $20,046 and $6,644 in new payrolls. A thousand acre development is expected to yield 320 new jobs. The mix of industries affected differs from agricultural production. Trade and services sectors show the greatest impact while fertilizer, farm machinery, and agricultural services receive almost no stimulus.

Regional Impacts of Refuge Activities

Almost anything humans do has an economic impact. National Wildlife Refuges are no exception. There are four basic avenues by which refuges affect the economy:

1. Ecosystem Services - By maintaining wildlife habitat and wetlands, the refuge provides services that are useful to society. Wetlands mitigate flood damage, prevent siltation and provide spawning habitat for fish. Trees absorb carbon dioxide from the air reducing greenhouse gases. People like knowing there is still land in its natural state nearby even if they do not personally recreate there. These effects are difficult to measure in the local economy. The national benefits of ecosystem services are discussed in the next chapter.

2. Recreation - Many refuges are open to visitors. Wildlife watching is a significant part of the tourism industry in the U.S. Refuges attract wildlife watchers to the area and lead to additional spending in local shops. Little Darby NWR may open up new public access to nearby creeks for fishing and canoeing.

3. Refuge Spending - A refuge is like a small business in the community with the added bonus that much refuge spending comes from outside the region. Rather than just recycling local dollars the refuge introduces new money from outside the area. Payrolls, construction, and other purchases stimulate additional spending in the local region.

4. Refuge Agriculture - Where it contributes to wildlife goals, farming is permitted on some refuges. Much of Little Darby is likely to remain farmland for some time with agricultural practices adapted to wildlife management goals. Some of the products from these activities will enter the commercial market.

Regional Impacts of Refuge Recreation

Where it is compatible with its wildlife related goals, a refuge may be opened for recreation. Many refuges provide wildlife watching, hunting, and fishing opportunities to visitors. It is impossible to say how much recreation may be permitted at Little Darby NWR until a management plan is developed much later in the refuge establishment process. However, it is possible to look at refuges which are similar in size, location, and other attributes to get an idea of how much recreation has occurred in similar situations. Refuge management staff believe Little Darby NWR will be similar to Minnesota Valley NWR, near Minneapolis MN. Like Minnesota Valley NWR , Little Darby NWR will be a river-wetland based refuge near a large metropolitan area with a strong environmental education program. Minnesota Valley NWR is 10,298 acres and received 126,000 visitors in 1997 (U. S. Department of the Interior, RMIS Public Use Files). Although Little Darby NWR will be three times as large when completed, it is expected to have roughly the same number of visitors. This number may be greater, however. Further we assume visitors will also hunt and fish in the same proportions. Dividing this number of visits by the acreage of the largest Little Darby NWR alternative yields the number of visitor days per acre per year.

The National Survey of Fishing, Hunting, and Wildlife-associated Recreation gathers information about what people spend in recreational pursuits. The average spending per day for each activity in Ohio is shown in Exhibit 2-3. Multiplying this by the number of visitor days per acre yields the number of dollars per acre that will be spent in the regional economy by hunters, anglers, and wildlife watchers. Summing these yields an estimate of the total annual spending by refuge visitors per acre of refuge, $93 per acre.

Exhibit 2-3. Visitor Spending per Acre (1998$).			
	Visitor Days per Acre	Dollars per Visitor Day	Dollars per Acre
Hunting	0.33	$16.55	$5.44
Fishing	0.14	15.01	2.12
Wildlife Watching	4.63	18.46	85.53
Total			$93.09
Source: US Dept of the Interior, 1997, and FWS Division of Economics calculation			

Referring back to Exhibit 2-2, the $93 attributable to each acre of the refuge increases output in the regional economy by $68 and personal income by $24. The largest components of visitor spending are food and gasoline. So much of the spending leaves the region quickly and is concentrated in the trade and services sectors.

Regional Impacts of Refuge Spending

As you visit a refuge, your first thought will not be that the refuge itself is a small business. But, someone has to pay the wildlife biologists, the maintenance workers, and environmental educators you

meet. Money from somewhere built the visitors center. Refuge workers, like anyone else employed in a local business, shop in the local supermarket and pay mortgages to the local bank. Functionally, there is very little difference between the economic activity generated by a refuge and that generated by a business with the same number of employees. Staffing is not directly related to the size of the refuge. Eufaula NWR with 11,000 acres has 6 permanent full-time staff while Horicon NWR with 21,000 acres has 7. Crab Orchard NWR is twice the size of Horicon NWR but has four times as many people.

Once it is well established Little Darby NWR is likely to become a regional flagship refuge with 10-15 permanent full-time staff. More than 60 percent of a refuge's budget is spent on salaries and benefits. With 10 employees, Little Darby NWR's operating budget will be approximately $800,000. This spending will increase output in the region by $759,000 and result in 12 new jobs in addition to the 10 at the refuge. Personal income will increase by $249,000.

In addition to operating revenues, the refuge is likely to require some new construction. Typically, local construction contractors are hired to build any necessary offices, roads, or visitors' facilities. It is impossible to estimate the extent of this impact at this time. However, for comparison purposes, the visitor facility at Neil Smith National Wildlife Refuge in Iowa was constructed at a cost of approximately $10 million.

Regional Impact of Refuge Agriculture

Many refuges lease lands for agricultural activities where it promotes the wildlife goals of the refuge. Often lands acquired for wetland restoration will be cooperatively farmed until funding is available to carry out the restoration. These leases may involve a money payment to the refuge or leaving a portion of the crop standing for wildlife winter use. Farmers are required to use integrated pest management and other "best management practices" on refuge lands. There may be additional constraints on farm practices to protect wildlife, such as delayed haying for ground nesting birds. In general, leasing refuge lands is less costly than leasing other lands but also somewhat less productive.

To estimate the impact of agriculture on the regional economy, we assume that the costs of production are the same as farming no-till corn while the yield is half as much because part of the crop is left for wildlife. The $70 return to land is not included as the partial crop is comparable to land rent. Because costs are the same, the impact on local agricultural suppliers is the same as any other farmed acre. The net producer surplus is considerably less than other farmland as the loss of yield is not compensated by the reduced land rent.

Comparison of Alternatives

Exhibit 2-2 summarized the impacts per acre of each land use type. Each refuge alternative represents a different pattern of future development for the study area. Exhibits 2-5 and 2-5a show the baseline pattern of development expected to exist in 2030 for each scenario and their respective alternatives.

Forecasting future land use is speculative. Much depends on the inclinations of individual landowners

and unpredictable economic cycles and local land use regulations/laws. For this analysis we relied on the Comprehensive Plan for Madison County (1994) and the Farmland Preservation Plan to be incorporated into the revised Comprehensive Plan. The **CP** combined characteristics of soil type, slope, and access to define the most favorable areas for future residential development. Flood plains and wetlands were excluded from development. According to the plan, Madison County has approximately 40,300 acres of land classified for preferred rural residential development. We assumed that the population increases shown in Exhibit 1-1 will be spread evenly over Madison County. The population increase was divided by the number of individuals per household in Madison County in the 1990 Census, 2.74, to determine the number of households that would be established. Each household was assumed to require a 2 acre parcel as suggested in the Comprehensive Plan. Households were allocated to alternatives based on the proportion of county developable land included in the alternative's footprint.   As each refuge alternative encompassed somewhat different areas, the distribution of residential and agricultural land becoming refuge land differs among alternatives.

Exhibit 2-5. **1994 CP**: Baseline Projected Land Use of Voluntary Purchase Area by Alternative, 2030, acres

		Alternative			
		1	2	3	4
Agricultural		21,482	19,108	17,766	17,632
Residential		1,589	1,852	1,529	1,702
Other		1,664	1,823	1,427	1,682
	Total	24,735	22,783	20,722	21,016
source: USFWS Division of Economics Analysis					

If the refuge is developed, we assume that all of this land will be acquired by 2030. This will show the largest possible impact. Obviously, as sales are voluntary all of the land may never be acquired. Also, the Service's intent is not to acquire incorporated or unincorporated villages or towns in the project area. Although Alternative 1 encompasses a larger land area than the other alternatives, less of the land is suitable for development. Alternative 1 would replace 1,600 acres of residential development with refuge activities while Alternative 2 would replace almost 1,900 even though it is 2,000 acres smaller.

Exhibit 2-5a shows the projected baseline land use for the FPP scenario in the Voluntary Purchase Areas. In contrast to the 1994 CP, the FPP would most likely result in less residential development and more land retained in agricultural use.

Exhibit 2-5a. **FPP**: Baseline Projected Land Use of Voluntary Purchase Area by Alternative, 2030, acres

		Alternative			
		1	2	3	4
Agricultural		22,364	20,248	18,634	18,622
Residential		707	712	711	712
Other		1,664	1,823	1,427	1,682
	Total	24,735	22,783	20,772	21,016
source: USFWS Division of Economics Analysis					

The state of development in 2015 is an interim point. The baseline amount of residential land is calculated from the population level expected in 2015. We assume that 60 percent of the refuge land will be acquired by 2015 and that the refuge lands are purchased in a pattern which minimizes residential development on lands which will become part of the refuge. This assumption implies that the Service always buys the next property that would have been developed. The effect of this assumption is to make the estimates of the impact of refuge acquisition on residential development an upper bound on plausible impacts. Service policy is to avoid buying residential property wherever possible.

An important component of the refuge plan is the Watershed Conservation Area where easements will be the Service's priority. The Fish and Wildlife Service and other agencies will work together to ensure that water quality in the refuge streams is maintained. One tool to accomplish this goal is to purchase development rights, or conservation easements to land in the watershed. Development rights are similar to easements or right-of-ways, in that they convey a partial interest in the land. In selling a development right the landowner relinquishes his right to develop the land. The landowner maintains all of the other rights of ownership including using it for less intensive purposes. The agency buying the development right does not gain any right to develop the land, only an enforceable right to stop the landowner from doing so (Wiebe et al.). Development rights may cover a period of years, after which time the landowner is again free to develop, or the rights may last in perpetuity and convey with the title to the land.

The Conservation Reserve Program (CRP) of the U. S. Department of Agriculture leases 10 year conservation easements from farmers who offer their land to the program and meet several environmental criteria. CRP participation in the project area counties has not been impressive. Less than 2.5 percent of farmland (17,000 ac) in the counties was in the CRP in 1998. It has declined since then. Similar efforts by The Nature Conservancy (TNC) in the Darby watershed have also met with mixed success. The Service may be able to offer more favorable terms than CRP or TNC and thereby attract more willing sellers.

To the extent it is successful, the Watershed Conservation Area will have similar effects as the refuge in mitigating residential development. Land in the program will remain private farmland rather than be developed. Terms of access to the land are part of the lease agreement. Typically, public access is not changed when a government agency buys development rights. So no new recreational opportunities will occur on the preserved farmland. The economic effect of the preservation is to forestall new residential development which would otherwise have occurred in the Watershed Conservation Area. The with/without analysis shows how the regional economy would have looked with the residential development compared to the alternative conservation path. Prospective development is allocated on the same basis as in the core refuge analysis. Exhibit 2-6 summarizes the baseline projections for the Watershed Conservation Area (Alternative 1 does not have a designated Watershed Conservation Area). Although the areas for each alternative are about the same size as the core refuge areas, they encompass less developable land. We maintain the "perfect foresight" assumption and assume that the rights to all of the areas ripe for development are acquired before development occurs. This means our results show the largest likely impact of mitigating development.

Exhibit 2-6. **1994 CP**: Baseline Projected Land Use of Watershed Conservation Area by Alternative, 2030, acres				
	Alternative			
	1	2	3	4
Agricultural	na	22,738	23,090	13,697
Residential	na	1,030	1,073	621
Other	na	2,651	1,074	1,596
Total	na	26,419	25,237	15,914
source: USFWS Division of Economics Analysis				

Exhibit 2-6a **FPP**: Baseline Projected Land Use of Watershed Conservation Area by Alternative, 2030, acres				
	Alternative			
	1	2	3	4
Agricultural	na	23,172	23,566	13,957
Residential	na	596	597	351
Other	na	2,651	1,074	1,606
Total	na	26,419	26,237	15,914
source: USFWS Division of Economics Analysis				

As with the Voluntary Purchase Area, the FPP scenario shows less residential development and more agricultural land use in 2030 compared with the 1994 CP scenario.

Exhibits 2-7 and 2-7a summarize the impacts on the regional economy of open land preservation in the voluntary purchase area for each alternative for both scenarios. (Detailed tables of the impacts appear in Appendices B and B1.) While the refuge generates between $3.2 to $3.7 million in new spending (Exhibit 2-7), it displaces agricultural activities which accounted for $4.8 to $5.8 million in spending. Refuge activities replace about 73 percent of the jobs displaced from agriculture. The difference of 20 or so jobs 30 years in the future is very small. When you recall that Fish and Wildlife Service operation and maintenance spending for any of the alternatives will contribute $800,000 in new spending and 22 new jobs (10 on the refuge and 12 off) for any of the alternatives, the difference between agriculture and refuge use is not great. Refuge construction spending will also mitigate any impact during the development period. It will be difficult to detect any effect of the refuge on net output or overall employment distinct from the normal fluctuations and ongoing trends in agriculture and recreation.

In the larger picture, refuge and agriculture are not the only alternatives. Baseline projections under the 1994 CP scenario suggest 1,500 to 1,900 acres of land in the voluntary purchase area will be developed for housing if no refuge is developed. These 750 to 950 new families would add spending of $27.7 to $33.6 million to the local economy. (Intuitively, if the average family spends about $36,000 per year, 750 multiplied by $36,000 is $27 million.) Northern Madison county added approximately 570 new families in the last nine years. So this is not an unusual rate of growth for the voluntary

purchase area over the next 30 years. Housing is a much more intensive use of the land than either refuge or agriculture so the impacts are almost an order of magnitude greater. Housing development would create 482 to 585 new jobs and almost $10 million in additional payroll.

Exhibit 2-7. **1994 CP**: Summary of Impacts of Voluntary Purchase Area, 2030				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Refuge				
Spending ($1998 thousands)	3,703	3,469	3,240	3,265
Output ($1998 thousands)	3,333	3,122	2,916	2,939
Jobs (Number)	54	51	49	51
Agriculture				
Spending	(5,865)	(5,207)	(4,871)	(4,804)
Output	(6,426)	(5,704)	(5,336)	(5,361)
Jobs	(74)	(66)	(59)	(64)
Residential				
Spending	(28,877)	(33,616)	(27,701)	(30,897)
Output	(31,512)	(36,684)	(30,229)	(34,381)
Jobs	(503)	(585)	(482)	(548)
source: USFWS Division of Economics analysis				

Alternative 1 encompasses the largest area so its impacts from agriculture and refuge activities are greater than the other three. Alternative 2, however, includes more developable land and has the largest impact on residential development. Given the economic assumptions and methods used, these values are only approximate. There is relatively little difference among the alternatives' economic impacts.

Exhibit 2-7a. **FPP**: Summary of Impacts of Voluntary Purchase Area, 2030				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Refuge				
Spending ($1998 thousands)	3,703	3,469	3,240	3,265
Output ($1998 thousands)	3,333	3,122	2,916	2,939
Jobs (Number)	54	51	49	51
Agriculture				
Spending	(6,119)	(5,511)	(5,088)	(5,074)
Output	(6,962)	(6,038)	(5,574)	(5,662)
Jobs	(81)	(68)	(62)	(68)
Residential				
Spending	(12,987)	(13,079)	(13,061)	(12,712)
Output	(14,173)	(14,273)	(14,253)	(14,145)
Jobs	(226)	(228)	(227)	(237)
source: USFWS Division of Economics analysis				

Exhibits 2-7 and 2-7a show each alternative's effect on the overall economy of the project area counties. Participants in the planning process expressed concern about the effect of refuge development on industries which supply agricultural enterprises. Exhibits 2-8 and 2-8a isolate the impacts on fertilizer, farm machinery, trade, and services. We assumed that 10 percent of the voluntary purchase area would continue to be farmed using the same methods as other farmland. As a result, fertilizer suppliers output would be about 20 percent of what it would have been in the VPA boundaries if the area remained farmland rather than converted to refuge use. Farm machinery dealers will still derive about 10 percent of the sales they might have received from the VPA area . As with all of the other impacts discussed here, these changes will phase in over 30 years. Fertilizer and farm machinery dealers will have ample time to adapt their business to changes in the landscape as they have to changes in agricultural technology in the past. Residential development provides almost no sales in the fertilizer or farm machinery sectors. Retail lawn fertilizer and garden tractors are classified in different sectors.

Refuge visitors contribute to the trade and service sectors so the impact on output of refuge development is much smaller in these sectors. Refuge activity generates more output of services than agriculture and about half as much trade output. Residential development dwarfs these effects. It would increase trade and services about 10 fold from the agricultural level to $8 to 10 million.

Exhibit 2-8. 1994 CP: Impacts of Voluntary Purchase Area on Output of Selected Industries, 2030 ($1998 thousands)				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Refuge				
Fertilizer	212	195	178	183
Farm Machinery	95	88	80	82
Trade	583	536	490	497
Services	1,005	924	845	871
Agriculture				
Fertilizer	(1,131)	(1,004)	(940)	(937)
Farm Machinery	(852)	(757)	(707)	(703)
Trade	(1,065)	(946)	(884)	(881)
Services	(908)	(807)	(755)	(758)
Residential				
Fertilizer	0	0	0	0
Farm Machinery	0	0	0	0
Trade	(8,583)	(9,992)	(8,234)	(9,364)
Services	(8,294)	(9,655)	(7,956)	(9,048)

The Watershed Conservation Area mitigates development that would have taken place in the area. The number of acres of agricultural land preserved matches the number of acres of residential development avoided. Land use was projected using the same method as the Voluntary Purchase area, i.e. using population projections and the proportion of developable land available within the Watershed Conservation Area boundaries. The method suggested 420 to 530 families would settle in the Preservation area if no action was taken to prevent development. The number of acres affected has no bearing on the actual number of acres to be covered by the acquired development rights. If the alternative does not change the land use from what would have existed under the baseline forecast, there is no economic impact. The only area that results in an economic impact is the area that would have been developed absent the Watershed Conservation Area.

Exhibit 2-9 and 2-9a show the effect of preserving agricultural land to avoid residential development. Under the 1994 CP scenario spending and output impacts of development are about 70 times as great as using the land for agriculture. Employment impacts are about 100 times as great for development as

for agriculture. Under the FPP scenario, spending and output impacts of development are about 70 times as great as using the land for agriculture. Employment impacts are about 60 times as great for development as for agriculture. Clearly, there is an economic impact of maintaining the current level of agriculture in the study area when compared to the probable future.

Exhibit 2-8a. FPP: Impacts of Voluntary Purchase Area on Output of Selected Industries, 2030 ($1998 thousands)				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Refuge				
Fertilizer	212	195	188	183
Farm Machinery	95	88	80	82
Trade	583	536	490	497
Services	1,005	924	845	871
Agriculture				
Fertilizer	(1,218)	(1,063)	(982)	(990)
Farm Machinery	(924)	(801)	(739)	(743)
Trade	(1,159)	(1,001)	(924)	(938)
Services	(989)	(856)	(788)	(802)
Residential				
Fertilizer	0	0	0	0
Farm Machinery	0	0	0	0
Trade	(3,860)	(3,888)	(3,882)	(3,853)
Services	(3,730)	(3,757)	(3,751)	(3,723)

Exhibit 2-9. 1994 CP: Summary of Impacts of Watershed Conservation Area, 2030				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Agriculture				
Spending ($1998 thousands)	na	276	288	167
Output ($1998 thousands)	na	303	316	186
Jobs (Number)	na	3	4	2
Residential				
Spending	na	(18,663)	(19,434)	(11,260)
Output	na	(20,367)	(21,209)	(12,530)
Jobs	na	(325)	(338)	(210)
source: USFWS Division of Economics analysis				

Exhibit 2-9a. FPP: Summary of Impacts of Watershed Conservation Area, 2030				
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**
Agriculture				
Spending ($1998 thousands)	na	159	159	94
Output ($1998 thousands)	na	177	177	104
Jobs (Number)	**na**	**3**	**3**	**1**
Residential				
Spending	**na**	**(10,691)**	**(10,691)**	**(6,301)**
Output	**na**	**(11,897)**	**(11,897)**	**(7,011)**
Jobs	**na**	**(191)**	**(191)**	**(117)**
source: USFWS Division of Economics analysis				

Caveats

There are several things to keep in mind when interpreting these impacts.

1. These are prospective impacts 30 years in the future. It is traumatic for a small community to lose 500 jobs when a factory closes but that is NOT the situation discussed here. The jobs attributed to residential development do not exist yet and will not exist for many years. They are presented as an alternative future course for the study area; they are not "lost" in the way a plant closing loses jobs. Secondary effects are also far in the future. A 40 year old farm machinery dealer could very well finish his career without noticing any effect from refuge acquisitions.

2. These impacts apply only to the two county project area. The remainder of the county will undoubtedly see massive residential development in the coming decades. The population of Madison County is expected to increase by almost one third by 2030. Less than 16 percent of the county's developable land is in the project area. So even if the refuge effort is completely successful in curtailing development in the project area, more than 4,000 new households will likely settle in Madison County generating about $144 million in new annual spending. These results must be viewed in the context of the county's changing character.

3. Development that is displaced from the project area will occur elsewhere. The increased jobs and income are not lost to the Columbus area but relocated. It would be more accurate to characterize the impact of the refuge as the incremental costs of developing someplace else rather than as the total lost spending. The forecasts required to perform that analysis would be extremely conjectural. Hopefully, the displaced development will be located in a less environmentally sensitive area.

4. The changes envisaged here are slow and well within the normal variability of labor markets. Farm employment in Ohio is projected to fall by 6,100 jobs from 1994 to 2005 (Ohio Bureau of Employment Services). The jobs figures are not necessarily full time. IMPLAN software includes part-time and seasonal workers in its jobs calculations. For example, a reduction of 74 agricultural jobs does not imply 74 farms ceasing operation immediately. It means that after 30 years of change and adaptation 74 of the hundreds of fewer jobs in the agricultural sector may be attributable to refuge development.

5. People adapt to change constantly. These figures are the MAXIMUM effects of the respective activities. In the normal span of a career individuals adapt to changing labor market conditions constantly. Although the impact would show the loss of a job as a result of declining agricultural land, the individual would be no worse off.

Local Government Costs and Tax Implications

Local government costs and revenues are largely dictated by the land uses within the jurisdiction. As land uses change new demands are placed on government provided roads, schools, and public safety services. Like agricultural land, refuges are a relatively low service land use. They do not send kids to the local schools, demand trash pickups, or require new roads. National Wildlife Refuges are not subject to local property taxes because they are federal lands. To mitigate the impact of this exemption on local tax collections, Congress has established the Refuge Revenue Sharing program (RRS) which distributes revenues from refuge resource use, and a federal appropriation, to refuge host communities. The payment is usually three-quarters of one percent (0.75 percent) of the fair market value of refuge lands in their alternative use, prorated to the extent of available funds. In recent years, payments have been prorated to 60 to 90 percent of the calculated payment due. Nevertheless, in some regions, refuge revenue sharing payments are greater than property tax revenues would have been from the same property. More often revenue sharing payments fall somewhat short of anticipated revenues.

Ohio's Current Agricultural Use Value (CAUV) program allows agricultural land to be appraised for tax purposes by soil type rather than by full market value. The program is intended to preserve farmland by eliminating the escalation in taxes as the value of the land for alternative uses increases. In 1997, for example, the taxable value of 269,391 acres in Madison County would have been $122 million in other uses but was $41 million under agricultural use valuation(Ohio Department of Taxation).

Exhibit 2-10 summarizes the revenue expected from refuge revenue sharing and CAUV taxes. More detailed tables by soil type and an explanation of the methods used to derive these estimates appears in Appendix C. As the timing of voluntary purchases and the resultant pattern of development by township is impossible to predict, it would be speculative to estimate the impacts on an individual school district or township. Instead, we estimate the tax yield from lands in each alternative by applying the lowest and highest effective tax rates in the five Madison County townships nearest the refuge to the lands included in each alternative. Two jurisdictions in Union county are affected; the highest and lowest tax rates are shown. Refuge revenue sharing payments are estimated by applying the 0.75 percent rate to the market value of land of each soil type and pro-rating the amount by the average level of funds available in recent years, 70 percent.

The exhibit shows that refuge revenue sharing payments are greater than the CAUV proceeds from the unimproved agricultural land in each refuge option at prevailing assessments and tax rates in the local area. Naturally, these estimates are subject to many uncertainties. CAUV valuation rates change triennially often by substantial amounts. However, tax rates are usually adjusted to minimize impacts. Land acquisitions may include only lower valued land or a different mix than the total for a given alternative. RRS funding levels change each year and may be higher or lower. Farm buildings and residences are subject to real property taxes which the refuge buildings are not. Whether these taxes cover the costs of providing services to such dispersed housing is an empirical question. The comparison leads to the conclusion that loss of property tax revenues to local governments from refuge land acquisitions should not be a major concern.

Exhibit 2-10. Comparison of Annual CAUV Assessment Revenues with Refuge Revenue Sharing Payments, 1999 rates, $1999 thousands.				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Madison County				
Refuge Revenue Sharing	$215	$171	$160	$163
CAUV at Lowest Rate	164	130	122	124
CAUV at Highest Rate	210	167	156	159
Union County				
Refuge Revenue Sharing	$11	$29	$36	26
CAUV at Lowest Rate	8	22	28	20
CAUV at Highest Rate	11	28	35	25
source: USFWS Division of Economics analysis				

Refuges may increase property tax revenues indirectly by increasing the value of nearby land. There is anecdotal evidence that home buyers are willing to pay a premium for lots near permanently protected open lands. A study being conducted by the University of Maine for the Fish and Wildlife Service will quantify this effect.

Some people believe a refuge may also affect farmland prices by reducing the supply of land in the vicinity. The Little Darby NWR study area is a small percentage of the farmland in the two project area counties and the Columbus metropolitan area. It is unlikely to have a measurable affect on land prices.

Housing places much heavier demands on public services than either farmland or refuge lands. Public or common sewage treatment facilities are required in much of the study area because of impermeable soils. Road maintenance, police, and fire services can also become overburdened. Studies for the Dublin Community Plan showed all forms of residential development generated negative returns for government services. Single family housing areas produced the worst deficit because they tend to have more people per household, require more roads, generate more trips, and cost more for solid waste services than more dense housing prototypes (Dublin Community Plan, 11/13/97, p. 5-16).

Schools are particularly costly to fast growing communities. Overcrowding due to rapid growth has become an issue in the Dublin schools. Per pupil costs in Madison-Plains Local School District, for example, were $5,088 in FY1997 of which $1,948 came from local revenue (Ohio Department of Education). These costs are typical of the experience in the area. The average property tax on a $100,000 assessed value property in Madison county in 1997 was $4,610 (Ohio Department of Taxation) which must cover the $3,623 cost of education for the average 1.86 children per household

with children as well as all other municipal services. On the whole new housing development barely covers the costs to educate the children it attracts. All other municipal services are subsidized by childless taxpayers or taxes on commercial enterprises.

In assessing the effects of different development paths, both the changes in revenues and costs must be considered. Conversion from agricultural to refuge use entails some incremental taxes foregone and very little change in the level of services required. Conversion from agricultural to residential land use entails increased revenue from both income and property taxes as well as large increases in the cost of government services.

Impact on School Districts

The proposed Little Darby National Wildlife Refuge boundaries including the Watershed Conservation and the Voluntary Purchase Areas (VPA) encompasses parts of the following school districts.

London City	Jefferson Local
Fairbanks Local	Jonathan Alder
Mechanicsburg	

The VPA would potentially affect only two districts, Jonathan Alder (JA) and Fairbanks. The former would have a larger part of its district (21 percent) affected by the VPA. Approximately 8 percent of the Fairbanks School District is included in the VPA.

Projected School District Development and Enrollment

The 1997 Study of Enrollments and Facility Adequacy, Capacity, and Utilization for the Fairbanks Local School District reported that of the 2,263 new residential units approved since 1990, 610 have been built in the general area of southeastern Union County. Of these units, 186 have been constructed in the three main townships served by the District, Darby, Millcreek, and Union (Planning Advocates Inc., 1997). The VPA does incorporate a small part of Union township in Union county. Based upon projected developments in the district, the report went on to say that "Growth is a sure thing for the school district".

Recently completed research for the JA School District estimated that a 1.0 to 2.8 percent annual growth rate in the student population should be expected (17-48 students/year at current student population level) (Futura Research, 1997). This estimate was predicated upon valid statistical controls for the past 6-12 years. Research done for the Fairbanks School District projected a "most likely" enrollment increase of 121 students (mean of 12 per year) and a "high" increase of 587 students (mean of 59 per year) for grades K-12 over a 10 year period commencing in 1997 (Planning Advocates Inc., 1997).

School District Funding

There are three essential considerations that would ultimately affect funding for any school district within

the boundaries of the proposed Little Darby National Wildlife Refuge. They are 1) school district revenue derived from the state education foundation formula, 2) school district revenue adjustments due to enrollment changes, and 3) school district revenue derived from separate or special residential levies.

Base Funding Level Derived from the Ohio State Education Foundation Formula.

For every school district in Ohio the state Department of Education determines a base funding level. This is determined by the following formula:

$$(SP \times FC/S) \times CDBF = \text{School District Base Funding Level}$$

SP   = Student Population   FC/S   = Fixed Cost per Student
CDBF = Cost of Doing Business Factor

In Ohio, each local school district is responsible for a share of the Base Funding Level. A significant part of this share is referred to as the "Charge Off" and is calculated by factoring the local millage rate, (up to a maximum of 23 mills) against the total assessed value of **all** types of property in the school district. The second part of each school district's share is composed of separate residential levies which is discussed later. The Base Funding Level, derived from the formula above, is guaranteed by the state. If the local school district's contribution declines, any difference between the "Charge Off" and the Base Funding Level is made up by the state. The following example funding distribution is for the JA School district.

Exhibit 2-11. Example Funding Distribution for Jonathan Alder School District	
State Foundation Formula	Jonathan Alder
Adjusted student population	1,712
times State reimbursement	$4,052 per student
times cost of doing business factor	1.0697
= Total State Formula	$7,420,535
Assessed Valuation	$150,315,570
times 23 mill charge-off	0.023
= Total Charge-off	$3,457,258
State Formula minus Charge-off	$3,963,276
source: Madison County Auditor, 2000.	

Potential Impacts to School District Revenue and Estimate of Enrollment Changes

The proposed VPA, 22,783 acres, would be deemed to have the only potential significant impact upon school district Base Funding Level. That impact would be only from the potential acquisition of improved property and subsequent loss of student population. The loss of student population is the only variable that would affect the overall school district base funding level as determined by the state. **It must be noted, however, that student enrollment is a "moving target" due to demographics, i.e. immigration, outmigration, new home construction, etc.. In addition, it is Service policy to avoid the purchase of improved or residential property if at all possible. In other words, the Service does not seek to acquire dwellings unless there is a management need, but will acquire them if that is the owner's wish and the Service proceeds with the acquisition.**

Estimated Assessed Value of Rural Residential Land and Buildings in the VPA

In order to formulate an estimate of impacts to residential land/structures, and subsequent affect of any loss in student population, some basic information is needed. Basically, the following is needed: 1) proportionate acreage of each township in the VPA, 2) estimated assessed valuation of affected property in the VPA, 3) proportionate number of residential dwellings for each township in the VPA, 4) estimated students per residence, 5) school district residential millage rate, etc.. Local school district revenue is primarily computed on the basis of assessed valuation of property and student enrollment (some districts have separate income taxes) Within the project area, only Fairbanks School District assesses an income tax. Exhibit 2-12 estimates the proportionate **assessed value** of rural residential land and buildings for each Township in Madison County affected by the VPA.

Exhibit 2-12. Estimated Assessed Value for Madison County Townships Affected by VPA for Alternative 2						
	(a)	*(b)*	*(c)*	*(d)*	*(e)*	*(f)*
Township	Total number of township acres in the VPA	Percent of total VPA	Total Township assessed value of Ag. land and buildings[5] ($000)	Total Ag. land and building acreage and percentage of total Township land[6]	assessment per acre *(c) / (d)*	Estimated assessment of land and buildings in VPA *(a) * (e)*
Canaan	278	1 %	$9,220	20,562 93 %	$448	$124,544
Deer Creek	2,734	12 %	$4,156	11,712 76 %	$372	$1,017,048
Monroe	10,357	45 %	$4,034	13,366 92 %	$302	$3,127,814
Pike	4,011	18 %	$5,384	18,278 98 %	$331	$1,327,641
Darby	1,010	4 %	$5,025	10,787 95 %	$466	$470,660
Somerford	1,891	8 %	$646[7]	2,883	$224	$378,784
totals	20,281	88 %	$23,440	75,588	$310	$6,446,491
assessment per acre = (sum of *(f)*) / (sum of *(a)*) = $318						

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[5] Assessed Values are taken from Madison County records and reflect rural residential property (county land use code 100). They do not include values for utilities, commercial developments, industrial, minerals, exempt lands, and higher density residential areas such as unincorporated villages and parts of incorporated towns.

[6] Except for Somerford township, this represents a majority of lands in each township.

[7] Actual statistics were provided by the Madison County Auditor

Impact of the VPA upon the Potential Reduction in the "Charge Off"

If we assume that the entire 20,281 acres in Madison County is acquired over 30 years, then that portion of the assessed value of land and buildings in the VPA becomes exempt for taxation purposes. In essence, the 23 mill "Charge Off" or JA School District contribution for that part of the county must be recovered to avoid any loss in revenue. If we use the total estimated assessed value of all property that is calculated in Exhibit A, then the 23 mill "Charge Off" would be determined as follows.

$$\$6,446,491 \; X \; .023 = \; \$148,269$$

As stated previously, this shortfall would be compensated by the state based upon the foundation formula. Basically, if revenue derived from the "Charge Off" to the JA school district declines, then the state makes up the estimated tax loss of $148 thousand. Consequently, this does not constitute a loss of school district tax revenue.

Estimate of Impact Upon Residences in the VPA

Exhibit 2-13 below lists the total number of residences present in each township (Madison County Auditor, 2000). With the exception of Somerford township, Exhibit 2-13 also calculates a proportionate number of residences (including mobile homes) that could be expected to be found in each township based upon the percentage of township area in the VPA (see Exhibit 2-12).

Exhibit 2-13. Total Residences (including mobile homes) in VPA Alternative 2 by Township in Madison County*		
Township	Total Existing Residences	Proportionate Number of Residences in VPA
Monroe	741	526 @ 71.1%
Pike	157	38 @ 24.2%
Deer Creek	366	64 @ 17.6%
Canaan	908	12 @ 1.3%
Darby	368	33 @ 8.9%
Somerford	1,104	5[8] na
Total	3,644	678 19%

*The number of residences in the VPA shown here is likely a significant over estimate of the actual number affected by the VPA since a large percentage are located in incorporated and unincorporated areas such as Plumwood and the Service has said it will not acquire residences in those areas.

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[8] actual number of residences in the JA School District were provided by the Madison County Auditor

The 1997 Study of Enrollments and Facility Adequacy, Capacity, and Utilization for the Fairbanks Local School District noted that the numbers of school - age children from new developments is very difficult to predict and national statistics estimate that it is .7 children per household (Planning Advocates Inc., 1997). For the purposes of this discussion, we may assume that every residence that is acquired has at least 1 student. Further, if we assume that 10-20 percent of the proportionate number of residences in the VPA (shown in Exhibit 2-13) will be purchased over the 30 year life of the project, then potentially 68-136 dwellings may be purchased. This equates to 2.3 to 4.5 houses per year. At 1 student per household, the same number of students would be potentially affected as well. According to the state school foundation formula allocation per student, this equates to a $9 to $18 thousand per year reduction in school district revenue .

Even if 30 percent of all residences in the VPA were acquired and we assumed 1 student per residence, this would only equate to approximately 6.8 residences, and the same number of students, per year. At this rate, it would mean a potential loss of 202 students over a 30 year period.

A reduction of 135 to 202 students (approximately 20-30 percent of all dwellings) from the JA school district over a 30 year period would be barely noticeable and likely be compensated for by predicted growth in other parts of the district. The report recently prepared for the JA school district by Futura Research projected a **1 to 2.8 percent increase per year** (17-48 students) in student enrollment (Futura Research, 1997). In addition, it is not entirely unreasonable to assume that families that do choose to relocate would attempt to remain in the school district. During the five year period from 1994-98, Madison County reported over 1,000 new residential units constructed (Madison County Auditor 2000). Of this total, 350 new units were reported within the townships potentially affected by the refuge.

The predicted growth in the Jonathan Alder and Fairbanks School Districts is anticipated to occur mostly within the sphere of the existing population centers of Plain City, Marysville, and West Jefferson. Presently, new development in the VPA is not being promoted or planned according to the recently completed Madison County Farmland Preservation Plan. Even though residential growth is not being promoted by the plan, some will likely occur under the conditional use zoning category suggested by it for residential lot splits of 20 acres or less.

Given the projections above and the pace of refuge development, we would estimate that the only deficiency in direct state base funding level relative to student enrollment would be that the rate of increase in student enrollment over time would be slightly reduced due to the project.

Estimated Impact of VPA Upon Separate School District Levies

The JA and Fairbanks School Districts have proportionately different acreage within the VPA. Approximately 24% of the JA School District falls within the VPA (Exhibit 2-14). Approximately 8% of the Fairbanks School District falls within the VPA.

Exhibit 2-14. Percent of the School District within the Alt. 2 VPA and WCA (School District acreages are taken from 1994 Census Bureau data, compiled by Wessex, Inc. 1997)		
	JA School District (68,982 ac)	Fairbanks School District (86,946 ac)
Voluntary Purchase Area	24	8
Watershed Conservation Area	9	18

Only the JA School District is considered here since the VPA has the greatest potential impact on this school district. For the purposes of this calculation we used the proportionate assessed valuation for the entire VPA in Madison county identified in Exhibit 2-12 to calculate the potential impact of the VPA upon the separate school district residential levies. This is separate from the "Charge Off" identified in the state formula.

The JA School District presently levies 1.59 mills ($1.59 per 1,000 dollars of assessed value) on agricultural and residential property in the district. The following formula is used to get an idea of how much this would represent annually for ALL rural residential property in the VPA.

SD Rate X Assessed Value of ALL Rural Land and Buildings .00159   X $6,446,491 = $ 10,250

This estimate is all inclusive, which means that it does not discount the portion that would be rolled into the annual Refuge Revenue Sharing payment for unimproved land. (The RRS Payment has been demonstrated to adequately augment Current Agricultural Use Value (CAUV) revenue shortfalls, including school district funding, even at the reduced rate of 70% funding, for rural residential and agricultural land). Again, when this is extended over a 30 year period and ignoring the consideration of anticipated new construction, the impact to the JA school district would be extremely small. The corresponding impact to the Fairbanks School District would be even less.

In summary, current school district revenue is not likely to be impacted significantly, or at all, from the proposed project. School District Base Level Funding is determined in the main from the state foundation formula. Any losses due to changes in the assessed valuation of property are compensated by the state up to a maximum determined by the formula. In the long run, regular re-assessment of property in the counties would possibly reduce the increase in the state contribution. Potential reductions in separate school district levies due to refuge acquisition will be compensated for by RRS payments. Overall, identifiable property and school district tax losses, due to the impact of refuge land acquisition should be marginal to nonexistent, over the 30 year life of the project.

The data, methods, and explanations in this assessment have been reviewed by the following persons for accuracy and rationale.

Mr. Paul Marshall, Director of Budget and Governmental Relations, Ohio Department of Education
Mr. James Williamson, Madison County Auditor

General Estimate of Impact Upon County Revenue

It needs to be made clear that the Service will not focus its land acquisition activities in any incorporated or incorporated villages or towns. The Service has no interest in acquiring any improved property within these established residential/community areas or mobile home parks.

The Service recognizes that perhaps the greatest impact to county revenue would occur from the potential disposal of residential structures that may be acquired within the VPA. In effect, the removal of buildings would reduce the overall assessed values by converting improved property to unimproved property and by changing their assessment to agriculture land. The Service would continue to appraise these lands according to the highest and best use that is legally permissible when determining future Refuge Revenue Sharing (RRS) payments. Appraisals by the Service , in some cases, will reflect mixed use on lands acquired which would be higher than those reflecting agricultural land use only. There is no perfect method for estimating what this devaluation will be. However, the Service has tried to measure this impact by using the same residences as were considered in the school district discussion.

Also, the Service did not assume that most residences, including mobile homes, would be concentrated in "parks", villages or towns. In fact, they may be concentrated or clustered in these areas in greater proportion to the overall townships. Instead the Service assumed that all residences and mobile homes were evenly distributed thoughout the VPA. In reality, this is not the case. Subsequently, the estimated impacts to county revenue is not only inflated due to the consideration of mobile homes as real property, but also from uniform distribution of residences.

The impact on county revenue is comprised of two parts: (1) Service acquisition of residential structures on acquired land in the VPA; and (2) the change in the acquired lands' assessment classification from improved residential to unimproved agriculture. For example, Service acquisition of a 100 acre farm with one acre of residential land and structures would entail a loss of the assessed value of the residential structures plus a loss of the difference between the assessed residential land value and the subsequent re-assessment of the land to unimproved agricultural land.

Exhibit 2-15 shows a summary of the lost county revenue due to Service acquisition of residential land and structures in the VPA.

Madison County Township	residences affected (low)	Residences affected (high)	Lost revenue: structures (low)	Lost revenue: structures (high)	Lost Revenue: land (low)	Lost revenue: land (high)	Total revenue lost (low)	Total revenue lost (high)
Canaan	2.4	3.6	$1,895	$2,836	$334	$500	$2,229	$3,336
Deer Creek	12.7	19.9	$4,758	$7,119	$851	$1,273	$5,609	$8,392
Monroe	104.6	156.6	$40,320	$60,330	$6,514	$9,752	$46,834	$70,082
Pike	7.6	11.3	$2,644	$3,956	$366	$544	$3,010	$4,500
Darby	6.6	9.9	$4,664	$6,978	$571	$856	$5,235	$7,834
Somerford	0.9	1.4	$445	$665	$134	$209	$579	$874
Totals	**135**	**202**	**$54,726**	**$81,884**	**$8,770**	**$13,134**	**$63,496**	**$95,018**

Exhibit 2-15. Summary of County Tax Revenue Losses from VPA Purchases*

*Mobile homes and single family residences were combined and treated as single family residences. This over estimates the actual tax revenue loses since mobile homes generate less revenue than single family residences but the table treats them as single family residences.

The totals shown in the last two columns represent annual lost revenues (in 1998 $) at the end of the 30-year purchase period for the low and high residential structure purchase estimates, respectively. See Appendix D for detailed information on the derivation of the estimates in the above table.

Summary

We used standard input/output techniques to estimate the regional economic impacts per acre of agricultural, residential, and refuge land uses. Projections of population growth in the project area and information about preferred areas for rural residential development along with estimates of residential development based on recent construction trends lead to estimates in the area each type of land use would cover with and without Little Darby National Wildlife Refuge. Combining these estimates yielded an estimate of the total regional impact of refuge development.

The analysis showed that when it is fully implemented in 30 years, the Voluntary Purchase area of the refuge and its associated recreation and cooperative agriculture would provide about 73 percent of the jobs and about 65 percent as much spending as the existing farmland. The services industries would increase output with a refuge while agricultural services and trade would experience a decrease in spending. When the additional impact of Fish and Wildlife Service spending for refuge operations and maintenance is considered, there is a relatively small difference between refuge and agricultural impacts. The trade-offs between agriculture and wildlife habitat are overshadowed by the impact of residential development displaced by the refuge. The largest refuge option considered under the 1994 CP may displace 74 agricultural jobs and 503 jobs related to residential development. Under the FPP scenario, the largest refuge option would displace 81 agricultural jobs and 226 jobs related to residential development. Residential development would greatly

change the character of the study area and its economy.

Although it would increase overall economic activity residential development also imposes more costs on the community. Among the largest of these is the cost of educating new residents' children. Anticipated taxes on new housing barely cover the cost of schooling leaving little to help with other public services or infrastructure. Revenue sharing from Little Darby NWR, on the other hand, compares favorably with the existing CAUV tax proceeds from agricultural land. Plus, refuges place few demands on county services.

The Watershed Conservation Area aspect of the Little Darby NWR will conserve agricultural land and displace residential development. The largest preservation area would result in 338 fewer jobs related to residential development while preserving 4 agriculture related jobs. The trade-off is similar for all three alternatives.

All of the changes discussed will be phased in slowly over 30 years. There will be ample time for residents to adapt to the changing environment. Residential development that would have occurred in the area will be displaced to other areas possibly also in the three study area counties. The changes predicted are within the normal variation for agricultural and recreational industries and are likely to be imperceptible against the broader trends in the national economy.

School district revenue would not be impacted. County revenue from a conversion of improved property to unimproved property would be marginally impacted.

Chapter 3. Social Benefits of the Refuge

The previous chapter discussed the impact of establishing a new refuge on spending in the region. Changes in dollar flows reflected in multiplier effects are important for local businesses but do not capture changes to the national economy. The recreation or agricultural production that occurs in the region would have occurred elsewhere in the country if it had not happened here. As mentioned above, people derive benefits from their activities over and above what they pay to pursue the activity. These benefits are termed the "consumer surplus" or "net economic value." Similarly, firms collect more than the cost of manufacturing their product. The margin provides a return to the firm for its expertise and for undertaking the risks of production. It is usually called "profit" or more formally "producer surplus." As they demonstrate the benefits people gain from their activities rather than just their spending, these surplus measures are better indicators of the change in the national well-being than local impact effects.

This chapter estimates and compares the social benefits from each of the alternative land uses in the Little Darby area and develops estimates of the change in well-being for each alternative refuge plan. This estimate is the benefit aspect of benefit-cost analysis which is an important consideration for all federal projects. The purpose of this analysis is to show the change in national welfare from each alternative future.

Refuge Recreation Consumer Surplus

Consumer surplus reflects what people would be willing to pay, not what they did pay, so it is more difficult to measure than spending. Several techniques have been developed to measure this amount. The contingent valuation method is frequently used for recreational valuation. One version of the method evokes a recreational situation, such as your last trout fishing trip, and asks anglers if they would have taken the trip if it cost $X more than it did. The dollar amounts differ among respondents so the responses define the range of values people are willing to pay for their recreational pursuit. The median of this range is often used as an estimate of the consumer surplus of the average person.

The Fish and Wildlife Service conducts a nationwide survey of fishing, hunting, and wildlife-associated recreation every five years which includes a contingent valuation question. Results of the 1996 survey are used in this report to estimate the consumer surplus from refuge recreation. The dollars per visitor day shown in the third column of Exhibit 3-1 for the three broad categories of refuge recreation were estimated from Ohio residents. These dollar amounts were weighted by the expected visitor days per acre, as in the expenditure analysis, and multiplied to give annual consumer surplus per acre of refuge recreation of $58.61. As in the earlier expenditure analysis, the types of recreation on the refuge and amounts ultimately depend on the refuge comprehensive conservation plan adopted.

Exhibit 3-1. Visitor Consumer Surplus per Acre (1998$).			
	Visitor Days per Acre	Dollars per Visitor Day	Dollars per Acre
Hunting	0.33	$21.61	$7.31
Fishing	0.14	15.43	2.25
Wildlife Watching	4.63	10.29	49.06
	Total		$58.61
Source: U. S. Department of the Interior, 1997, and USFWS Division of Economics calculation			

Other Refuge Functions

Several aspects of refuge development, other than recreation, contribute benefits to the national well-being. These are more difficult to place a value on than recreational consumer surplus or agricultural profits but equally as real.

Value of the Refuge as Endangered Species Habitat

Little Darby NWR will be important habitat for several rare and declining species. Several species of mollusks in the Little Darby Creek are on the federal endangered species list or are being monitored due to their population status. In addition, various migratory birds will use the wetlands and uplands created within the refuge. Surveys have shown that people are willing to pay to save threatened or endangered species.

Exhibit 3-2. Annual Household Willingness to Pay for Endangered Species Preservation, Selected Studies		
Citation	Species	Mean WTP, $1993
Bowker and Stoll, 1988	Whooping Crane	31.81
Boyle and Bishop, 1987	Bald Eagle	15.40
Boyle and Bishop, 1987	Striped Shiner	6.04
Cummings, et al 1994	Squawfish	8.42
Loomis and Larson, 1991	Gray Whale	19.23
source: Loomis and White, 1996		

Most of the studies in the field have dealt with large familiar animals, such as bald eagles and humpback whales. However, a 1985 study by Boyle and Bishop asked Wisconsin taxpayers' their willingness to pay to preserve the bald eagle and the striped shiner. Like the Darby Creek mussels, the striped shiner is a little known aquatic species with no human use, so values expressed for it may be similar to those for the mussel species. Boyle and Bishop found the median willingness to pay was one dollar per year in 1985 dollars. The mean willingness to pay was 4.16 to 5.66 showing that some individuals were willing to pay far more than $1.00 annually. Adjusted for inflation by the GDP Implicit Price Deflator, the median is $1.44 per year in 1998 dollars. Applied to all the people in the Columbus metropolitan area or all of Ohio, $1.44 per person adds up. The Columbus metropolitan statistical area has a population of 1.45 million people which translates into a value of $2.1 million. As the refuge contributes to the preservation effort, some portion of that value

will accrue to the refuge. (Note: The $2.1 million figure should be considered a broad, ballpark figure illustrative of the potential magnitude of this type of value).

Value of Preserving the River Resource
Absent endangered species, people still express a desire to preserve open lands. Kline and Wichelns (1998) found that respondents concerned about environmental or agrarian values preferred to preserve lands with no public access. These groups apparently felt preservation was better served by excluding public use and maintaining local farms. Preserving open space also prevents commitment of land resources to a single use. Once land is developed for housing it is very difficult to convert it to another use. In maintaining open space, society maintains the option to choose some other use for the land sometime in the future. The value of keeping these options open can be estimated with enough information.

Pei-Ing Wu (1991) asked Ohioans to value resource management projects to maintain water quality and improve hiking trails along Big Darby Creek. The values obtained reflect both preservation and use values of respondents. Wu estimated the annual willingness to pay per household as $2.54 to $11.78 in 1990 dollars. This is $3.06 to $14.18 in 1998 dollars. The range of values reflects several different calculation methods and attribution of zero or the mean value to non-respondents. There are 525,000 households in the Columbus metropolitan area. Applying these average willingness to pay values to that area implies a benefit of $1.6 to $7.4 million annually. Although this amount is not additive with the value expressed above because it includes some of the attributes included in the habitat preservation value, it also expresses a value for the protection of the creeks.

Ecosystem benefits
One of the goals of Little Darby NWR is preservation and restoration of migratory bird habitat. As a functioning ecosystem, the refuge will produce birds and other living things which are objects of human recreation and use.   Migratory bird hunting is enjoyed by 3.1 million participants each year (U.S. Department of the Interior, 1997). It is a $3 billion industry in the United States generating almost 96,000 jobs (Southwick). To the extent Little Darby contributes to the production of birds that are eventually hunted, some of the benefits of hunting can be imputed back to the refuge. The Economic Research Service of the U.S. Department of Agriculture has undertaken a study of bird banding and recovery to quantify this benefit for birds produced in the Prairie Pothole region.

Other migratory birds are sought out for bird watching or simply valued for their existence.   A recent study of nondescript grassland birds in Iowa demonstrated that even households distant from the birds themselves valued their existence and would contribute money to programs to improve their habitat (Hagler Bailly). Little Darby NWR would undoubtedly generate similar non-use values for improved bird habitat.

The plant community also provides benefits to society. Recent concerns about global climate change have brought attention to the balance of greenhouse gases released and absorbed across the country. One tool for reducing atmospheric carbon dioxide, a greenhouse gas, is to sequester it in long-lived plant biomass and soil. The Kyoto protocol recognizes the benefits of carbon sequestration in newly forested areas and improving soils as an offset to carbon dioxide emissions. Although the area likely to be reforested at Little Darby NWR is small, restoration of grassland ecosystems will result in soil sequestration.   The refuge will contribute to the overall effort to ameliorate global climate change.

By slowing runoff and providing space where water can flood without damaging buildings and roads, wetlands reduce damage from storms and flooding. Highly developed areas with large impervious surfaces are particularly vulnerable to flash floods precipitated by intense rainstorms. Franklin county suffered such a flood in June 1998 (Columbus Dispatch, 6/30/98, "County cleans up in aftermath of storms"). Intensive development will accelerate runoff and place more structures in harm's way. Wetlands also retard spring runoff which mitigates seasonal flood events. The Army Corps of Engineers values the benefits of flood mitigation by estimating the amount of damage prevented by the project. A similar calculation could be performed for wetland preservation. As flood mitigation is not a goal of Little Darby and the hydrology is complex, these benefits will not be estimated here

Agriculture Producer Surplus

Producer surplus, or profit, is easier to measure as production costs and prices received are well known. Subtracting the total expenses of production for each crop from the crop budgets yields an estimate of producer surplus per acre as shown in the last line of Exhibit 2-2. Crop prices, at present, are low and do not create a producer surplus. Farmers will continue to farm as long as the returns exceed their variable costs and thereby cover a portion of their fixed costs. However, in those circumstances they do not earn a return on their management and entrepreneurial skills. In the long run and in the absence of other effects, land values will adjust to changes in crop prices and producer surplus will be capitalized into the cost of land. That is, if crop prices remain low, farmers will be less willing to pay for farmland which does not produce a profit and the price for land will fall. The adjustment process reverses if farmland can produce a profit. If the proposed action increased farmland or permitted more intensive production, national producer surplus might be generated. As it does neither of these and our perspective is long term, we assume no agricultural producer surplus effect occurs.

Residential Development Consumer Surplus

Suburban housing provides consumer surplus to residents. Families often pay a premium for houses away from the congestion of center cities. The housing market is very well informed and functions on a offer/counter-offer basis which acts like an auction to extract the maximum the buyer is willing to pay for the package of attributes in the new home. Therefore, we assume that all of the housing consumer surplus is capitalized into the price of the home so housing does not generate incremental consumer surplus in consumption.

Comparison of Alternatives

Exhibit 3-3 summarizes the changes in consumer and producer surplus from refuge development. Alternative 1 generates slightly more benefits than the other alternatives because it is considerably larger but there is very little difference among the alternatives. A formal cost-benefit analysis would compare the discounted value of future benefit flows with discounted future costs. If benefits are greater than costs then the project is a net benefit to the nation. Reliable cost estimates were not available for this analysis. (Note: Given the lack of site-specific consumer surplus data regarding recreational use of the refuge, the previously cited recreational values have been reduced by 25 percent to produce a more conservative estimate of these values).

Exhibit 3-3. National Social Benefits of Alternatives, 2030 ($1998, thousands)				
	Alternative			
	1	2	3	4
Refuge Recreation	1,087	1,002	913	924
Other Refuge Benefits	1,575	1,575	1,575	1,575
Agriculture	A	A	A	A
Residential	B	B	B	B
Total	2,662	2,577	2,488	2,499
A - Producer surplus is capitalized in land values in the long term.				
B - Consumer surplus for housing is captured in real estate prices.				
source: USFWS Division of Economics analysis				

The Watershed Conservation Area provides very little change in measurable national social benefits. There will probably not be any new recreational opportunities in the Watershed Conservation Area. Recreation is only permitted on land under easement with the landowners permission so there is no change in recreational consumer surplus. By our assumptions, housing development does not provide added consumer surplus. The Watershed Conservation Area contributes to habitat and other features which yield unquantified social benefits discussed below.

Summary

All of the refuge alternatives produce national benefits of at least $1.5 million annually. Conversion of land to refuge use provides more benefits than any of the other options by preserving valued natural resources and contributing to the recreational opportunities in central Ohio. In addition to the recreational benefits, unmeasured ecosystem and endangered species benefits could double the estimated level of benefits.

Chapter 4. Other Socio-Economic Issues

Changes to the Agricultural Infrastructure

The study area has a strong tradition of intensive production agriculture. The land has been farmed since it was cleared in the last century. In the last twenty years, growth of manufacturing industries in the Columbus area and the ensuing expansion of the city and suburbs has led to losses of farmland close to the city and near major highways. More than most industries, agriculture depends on a critical mass of firms in a geographic area pursuing the same line of business to achieve economies of scale. Agricultural suppliers and service industries need a large enough market for their products to stay in business. If the farm suppliers close, the remaining farmers will face higher costs of doing business. So the loss of farmland in the Columbus area is a major concern for agricultural interests.

Among the goals of Little Darby NWR is preservation of farmland as an alternative to urban sprawl and as a complement to the refuge VPA. In some areas, refuge goals will be met by acquiring development rights rather than fee title to land. Sale of development rights ensures that land will not be developed for commercial or residential uses and can continue to be farmed indefinitely. The price of such encumbered land is lower than unencumbered farmland because some uses of the land are precluded. Usually farming can continue on the land with little change. In some cases more environmentally benign practices such as conservation tillage and fencing of wetlands would be required as negotiated in the easement. Nevertheless the amount of farmland is unchanged and the critical mass of farmers is maintained.

Land held in fee title by the refuge may be farmed cooperatively to achieve wildlife goals.
Many refuges have extensive leased farm operations. Often the lessee receives a share of the crop and the refuge keeps a share to leave for overwintering wildlife. Farming methods are constrained to maintain habitat quality. Often hay cutting is delayed until groundnesting birds have fledged, for example. Refuge agriculture is expected to be a temporary phase at Little Darby NWR until funds are available for restoration on wetlands or other habitat. As long as it lasts, cooperatively farmed land remains in the critical mass of farmed land to maintain the agricultural infrastructure.

Federal acquisition of all 24,735 acres in the most extensive alternative would account for 1.6 percent of the 1997 land in farms in the Columbus area. Other causes have resulted in a 9.5 percent loss of farmland in the Columbus area from 1982 to 1997, primarily in Franklin county. The largest refuge alternative would encompass 4.8 percent of the farmland area of the two study area counties when it is complete. This is about 80 percent of the loss that has occurred in Madison and Union counties since 1982. Farm acreage is higher in 1997 than 1992 in Fairfield county.

Exhibit 4-1. Land in Farms in the Columbus Area, 1982-1997				
(thousand acres)				
Counties	1982	1992	1997	Percent Change 1982-1997
Delaware	196	185	179	-8.7%
Fairfield	232	212	214	-7.8%
Franklin	144	113	108	-25.0%
Licking	270	252	247	-8.5%
Madison	285	270	268	-6.0%
Pickaway	298	270	264	-11.4%
Union	252	242	238	-5.6%
	1,677	1,544	1,518	-9.5%
source: Ohio State University Extension, *1999 County Profiles*				

Some land acquired for the refuge will be restored to wetland conditions. This land will be removed from the agricultural critical mass as well as the land market. Accurate evaluation of the effect of the refuge on the agricultural services should focus only on this subset of refuge lands. One concern expressed in scoping meetings was the effect on farm equipment prices if one of the three equipment dealers serving the area is unable to continue. The regional impact analysis showed gross reductions in farm machinery output of $707,000 to $852,000 for the 1994 Madison County CP scenario, and between $739,000 and $924,000 under the Madison County FPP scenario. Considering the unit costs of farm machinery and the fact that these reductions will be spread among all the area dealers over a period of 30 years, it is difficult to believe this would be a sufficient loss in trade to cause any individual dealer to close. To realistically assess the results of such a loss in sales would require detailed analysis of the personal financial condition of each dealer and evaluation of their business practices. This is beyond the scope of the current analysis.

Agricultural Land Values and Ownership

Another concern which has been raised about the refuge is its affect on agricultural land values. The argument runs that by removing land available for agriculture the value of the remaining agricultural land will increase; farm operators will be required to pay more taxes and they will be driven out of business. The argument is spurious but useful as it leads to the root of much of the anxiety about the refuge proposal.

First, the value of land for agriculture, like all productive assets, derives from the expected value of the future earnings from using it. As long as the next best use is agriculture, commodity prices and productivity dictate the value of agricultural land. Think of agricultural land as a machine for producing food. If you had a widget-making machine and there were millions of widget-making machines around the world, the value of the machine would depend on its productivity and the price of widgets. Whether there were 12 or 20 in the greater Columbus area would be irrelevant. Removal of cropland for a refuge will not affect the price or remaining farmland as agricultural land.

Agriculture is not the only use for Madison county farmland. Other uses may be able to pay more for the land than expected agricultural earnings. Developers, for example, can pay more for the land because they will install infrastructure and houses and sell it for more intensive use. Because location near cities and highways is important for development, there is a limited quantity of suitable land. Demand for more intensive alternative uses of farmland increases the value of the land when there is a limited supply. Removing development land from the market through voluntary purchase and farmland preservation activities may raise the price of land suitable for these more intensive uses.

Increasing land prices are not necessarily a problem for farmland owners. CAUV assessments protect landowners from increasing taxes. Mortgage payments are tied to the purchase price rather than the current value. So there is no compulsion for current landowners to sell. The existence of a refuge does not change the current landowner's economic choices.

In Madison county, more than half of the cropland is worked by people who do not own it. The owner of a resource is the sole decision-maker for its use in the American capitalist system. There are few constraints, such as zoning and liability issues, on landowners' use decisions. In other systems of economic organization, the workers or community have more of a say in how land is used. Such consultation is foreign to U.S. traditions. The introduction of a refuge gives the landowner one more possible buyer. No doubt the landowner attracted to the Service's fair market value offer would also be attracted by similar offers from other sources. It is the possibility of alternative uses that drives land out of agriculture, not the presence or absence of a refuge. Regulation of alternative uses is best addressed in county comprehensive planning and zoning enforcement.

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Appendix A. Detailed Crop Budgets

These tables are adapted from *Ohio Enterprise Budgets, April 1999* published by the Ohio State University Extension. Items without units indicated are charges based on average experience.

Production Budgets per Acre		Corn (No Till)	
	Price	**Amount**	**$**
Bu/Ac		130	
Seed corn ($/1000 kernels)	$1.10	28	$31
Fertilizer ($/lb)			
N	$0.23	140	32
P2O5	$0.28	45	13
K2O	$0.13	50	7
Lime	$14/ton	1000	7
Chemicals			32
Fuel, Oil, Grease			8
Drying ($/point)	$0.01	10	13
Trucking-fuel only ($/bu)	$0.03	120	4
Repairs			5
Miscellaneous			13
Machinery & Equipment Charge			41
Total Allocated Costs			$206
Interest			7
Labor ($/hour)	$7.50	3.5	23
Land Charge			85
Management Charge			13
Total Cost			$334

Production Budgets per Acre		Soybean (No Till)	
	Price	**Amount**	**$**
Bu/Ac		40	
Seed soybeans ($/lbs)	$0.28	80	$22
Fertilizer ($/lb)			
P2O5	$0.28	30	8
K2O	$0.13	75	10
Lime	$14.00	750	5
Chemicals			23
Fuel, Oil, Grease			8
Trucking-fuel only ($/bu)	$0.03	40	1
Repairs			5
Miscellaneous			13
Machinery & Equipment Charge			41
Total Allocated Costs			$136
Interest			4
Labor ($/hour)	$7.50	2.0	15
Land Charge			85
Management Charge			9
Total Cost			$249

Production Budgets per Acre		Wheat	
	Price	**Amount**	**$**
Bu/Ac		60	
Seed wheat ($/lb)	$0.20	120	$24
Fertilizer ($/lb)			
N	$0.24	60	14
P2O5	$0.23	40	11
K2O	$0.13	40	5
Lime	$13.50	1000	7
Chemicals			7
Fuel, Oil, Grease			9
Trucking-fuel only ($/bu)	$0.03	45	2
Repairs			6
Miscellaneous			13
Machinery & Equipment Charge			47
Total Allocated Costs			$145
Interest			6
Labor ($/hour)	$7.50	1.5	11
Land Charge			85
Management Charge			7
Total Cost			$254

Appendix B. Detailed Impact Results for 1994 CP Scenario

All amounts are 1998 dollars except acreage figures and employment which is number of jobs. These are annual figures for the year indicated. Although they will continue for the life of the alternative, in reality the local economy will adapt to the change over time.

The figures have not been discounted. As there is no way to estimate the timing of impacts at this stage of planning showing present values of discounted time series would be misleading.

Although results are shown to the dollar, this does not imply accuracy at that level. Input-output analysis does not lend itself to calculation of formal confidence limits. These estimates should be used as a general indication of the overall magnitude of the impacts, not as a precise indicator of how each industry in the study area would be impacted by the scenario.

Note: It is assumed that refuge recreation takes place across the entire refuge. Therefore the total acreage figure under **Refuge Impacts** is the same as the acreage figure under Recreation.

Column sums may not equal column totals because of rounding.

Alternative 1	Agricultural Impacts				Residential	Refuge Impacts		
Voluntary Purchase Area	**Corn**	**Soybeans**	**Wheat**	**Total**	**Development Impacts**	**Recreation**	**Agriculture**	**Total**
2030 Acreage Change	(7,519)	(12,245)	(1,719)	(21,482)	(1,572)	24,735	2,474	24,735
Spending	(2,437,204)	(2,995,440)	(432,986)	(5,865,630)	(28,876,672)	2,305,154	598,819	2,903,397
Total Impact on:								
Output	(2,807,725)	(3,108,239)	(509,962)	(6,425,926)	(31,512,312)	1,683,884	903,572	2,587,456
Personal Income	(790,444)	(951,769)	(149,140)	(1,891,353)	(10,444,368)	594,312	254,366	848,678
Employment	(30)	(38)	(6)	(74)	(503)	22	10	32
Output Impact of Selected Industries								
Fertilizer	(658,704)	(390,152)	(82,628)	(1,131,484)	0	0	211,971	211,971
Farm Machinery	(296,417)	(457,420)	(98,625)	(852,462)	0	0	95,387	95,387
Other Manufacturing	(148,208)	(214,018)	(38,488)	(400,714)	(1,186,860)	135,839	47,693	183,532
Trade	(403,456)	(582,470)	(79,380)	(1,065,306)	(8,583,120)	452,797	129,834	582,631
Services	(354,053)	(488,795)	(65,970)	(908,818)	(8,293,872)	891,468	113,935	1,005,403
2015 Acreage Change	(4,577)	(7,454)	(1,046)	(13,077)	(738)	14,858	1,486	14,858
Spending	(1,485,554)	(1,825,817)	(188,948)	(3,500,319)	(13,556,605)	1,383,092	359,291	1,742,383
Total Impact on:								
Output	(1,711,399)	(1,894,572)	(222,539)	(3,828,510)	(14,793,948)	1,010,330	542,117	1,552,447
Personal Income	(481,801)	(572,955)	(65,082)	(1,119,838)	(4,903,272)	356,587	152,619	509,206
Employment	(18)	(23)	(2)	(43)	(236)	13	5	18
Output Impact of Selected Industries								
Fertilizer	(401,500)	(237,810)	(36,057)	(675,367)	0	0	127,182	127,182
Farm Machinery	(180,676)	(278,812)	(43,038)	(502,526)	0	0	57,232	57,232
Other Manufacturing	(90,338)	(130,452)	(16,795)	(237,585)	(557,190)	81,503	28,616	110,119
Trade	(245,920)	(355,034)	(34,640)	(635,594)	(4,029,480)	271,678	77,899	349,577
Services	(215,807)	(297,937)	(28,788)	(542,532)	(3,893,688)	534,881	68,361	603,242

Alternative 2	Agricultural Impacts				Residential	Refuge Impacts		
Voluntary Purchase Area	**Corn**	**Soybeans**	**Wheat**	**Total**	**Development Impacts**	**Recreation**	**Agriculture**	**Total**
2030 Acreage Change	(6,688)	(10,892)	(1,529)	(19,108)	(1,830)	22,783	2,278	22,783
Spending	(2,163,334)	(2,658,841)	(384,331)	(5,206,506)	(33,615,973)	2,118,772	550,402	2,669,174
Total Impact on:								
Output	(2,492,220)	(2,758,965)	(452,657)	(5,703,842)	(36,684,180)	1,547,734	830,473	2,378,207
Personal Income	(701,622)	(844,578)	(132,381)	(1,678,581)	(12,158,520)	546,259	233,799	780,058
Employment	(26)	(34)	(6)	(66)	(585)	20	9	29
Output Impact of Selected Industries								
Fertilizer	(584,685)	(346,310)	(73,342)	(1,004,337)	0	0	194,832	194,832
Farm Machinery	(263,108)	(406,020)	(87,542)	(756,670)	0	0	87,674	87,674
Other Manufacturing	(131,554)	(189,969)	(34,162)	(355,685)	(1,381,650)	124,856	43,837	168,693
Trade	(358,119)	(517,017)	(70,461)	(945,597)	(9,991,800)	416,186	119,335	535,521
Services	(314,268)	(433,870)	(58,557)	(806,695)	(9,655,080)	819,389	104,722	924,111
2015 Acreage Change	(4,096)	(6,671)	(936)	(11,703)	(859)	13,656	1,366	15,022
Spending	(1,325,060)	(1,628,561)	(235,408)	(3,189,029)	(15,779,301)	1,271,263	330,241	1,601,504
Total Impact on:								
Output	(1,526,505)	(1,689,887)	(277,255)	(3,493,647)	(17,219,514)	928,641	498,284	1,426,925
Personal Income	(429,749)	(511,054)	(81,084)	(1,021,887)	(5,707,196)	327,756	140,279	468,035
Employment	(16)	(20)	(3)	(39)	(275)	12	5	17
Output Impact of Selected Industries								
Fertilizer	(358,124)	(212,118)	(44,923)	(615,165)	0	0	116,900	116,900
Farm Machinery	(161,156)	(248,690)	(53,620)	(463,466)	0	0	52,604	52,604
Other Manufacturing	(80,578)	(116,358)	(20,925)	(217,861)	(648,545)	74,913	26,302	101,215
Trade	(219,351)	(316,677)	(43,158)	(579,186)	(4,690,140)	249,712	71,601	321,313
Services	(192,492)	(265,748)	(35,866)	(494,106)	(4,532,084)	491,633	62,834	554,467

Alternative 3	Agricultural Impacts				Residential	Refuge Impacts		
Voluntary Purchase Area	Corn	Soybeans	Wheat	Total	Development Impacts	Recreation	Agriculture	Total
2030 Acreage Change	(6,218)	(10,127)	(1,421)	(17,766)	(1,508)	20,772	2,077	20,772
Spending	(2,023,977)	(2,487,563)	(359,573)	(4,871,113)	(27,701,031)	1,937,342	503,271	2,440,613
Total Impact on:								
Output	(2,331,676)	(2,581,238)	(423,498)	(5,336,412)	(30,229,368)	1,415,202	759,359	2,174,561
Personal Income	(656,425)	(780,616)	(123,852)	(1,560,893)	(10,019,152)	499,483	213,779	713,262
Employment	(24)	(31)	(4)	(59)	(482)	19	8	27
Output Impact of Selected Industries								
Fertilizer	(547,021)	(324,002)	(68,618)	(939,641)	0	0	178,149	178,149
Farm Machinery	(246,159)	(379,864)	(81,903)	(707,926)	0	0	80,167	80,167
Other Manufacturing	(123,080)	(177,732)	(31,963)	(332,775)	(1,138,540)	114,164	40,083	154,247
Trade	(335,050)	(483,712)	(65,922)	(884,684)	(8,233,680)	380,548	109,116	489,664
Services	(294,023)	(405,920)	(54,784)	(754,727)	(7,956,208)	749,225	95,755	844,980
2015 Acreage Change	(3,784)	(6,163)	(865)	(10,812)	(708)	12,487	1,249	13,736
Spending	(1,236,667)	(1,519,922)	(219,702)	(2,976,291)	(13,005,524)	1,162,405	301,962	1,464,367
Total Impact on:								
Output	(1,424,673)	(1,577,158)	(258,760)	(3,260,591)	(14,192,568)	849,121	455,616	1,304,737
Personal Income	(401,108)	(476,963)	(75,674)	(953,745)	(4,703,952)	299,690	128,267	427,957
Employment	(15)	(19)	(3)	(37)	(226)	11	4	15
Output Impact of Selected Industries								
Fertilizer	(334,235)	(197,971)	(41,926)	(574,132)	0	0	106,889	106,889
Farm Machinery	(150,406)	(232,100)	(50,043)	(432,549)	0	0	48,100	48,100
Other Manufacturing	(75,202)	(108,595)	(19,530)	(203,327)	(534,540)	68,499	24,050	92,549
Trade	(204,718)	(295,552)	(40,279)	(540,549)	(3,865,680)	228,329	65,470	293,799
Services	(179,651)	(248,021)	(33,474)	(461,146)	(3,735,408)	449,535	57,452	506,987

Alternative 4	**Agricultural Impacts**				**Residential**	**Refuge Impacts**		
Voluntary Purchase Area	**Corn**	**Soybeans**	**Wheat**	**Total**	**Development Impacts**	**Recreation**	**Agriculture**	**Total**
2030 Acreage Change	(6,171)	(10,050)	(1,411)	(17,632)	(1,682)	21,016	2,102	21,016
Spending	(1,996,227)	(2,453,458)	(354,644)	(4,804,329)	(30,897,304)	1,956,351	508,209	2,464,560
Total Impact on:								
Output	(2,343,826)	(2,591,122)	(425,797)	(5,360,745)	(34,381,763)	1,465,321	781,522	2,246,843
Personal Income	(659,963)	(779,560)	(123,872)	(1,563,395)	(11,385,772)	516,817	220,057	736,874
Employment	(25)	(33)	(6)	(64)	(548)	20	9	29
Output Impact of Selected Industries								
Fertilizer	(550,180)	(319,559)	(67,676)	(937,415)	0	0	183,452	183,452
Farm Machinery	(246,134)	(374,656)	(82,481)	(703,271)	0	0	82,070	82,070
Other Manufacturing	(126,433)	(175,295)	(32,693)	(334,421)	(1,295,621)	115,285	42,158	157,443
Trade	(337,377)	(477,081)	(66,575)	(881,033)	(9,364,204)	384,282	112,494	496,776
Services	(296,410)	(407,901)	(54,034)	(758,345)	(9,048,401)	768,564	102,045	870,609
2015 Acreage Change	(3,776)	(6,150)	(863)	(10,789)	(793)	12,596	1,260	12,596
Spending	(1,221,602)	(1,521,836)	(217,026)	(2,960,464)	(14,566,922)	1,172,544	304,597	1,477,141
Total Impact on:								
Output	(1,434,318)	(1,585,651)	(260,569)	(3,280,538)	(16,209,713)	878,244	468,407	1,346,651
Personal Income	(403,868)	(477,056)	(75,805)	(956,729)	(5,367,965)	309,756	131,891	441,647
Employment	(15)	(20)	(3)	(38)	(258)	12	5	17
Output Impact of Selected Industries								
Fertilizer	(336,686)	(195,556)	(41,416)	(573,658)	0	0	109,952	109,952
Farm Machinery	(150,622)	(229,273)	(50,475)	(430,370)	0	0	49,189	49,189
Other Manufacturing	(77,372)	(107,273)	(20,006)	(204,651)	(610,837)	69,096	25,267	94,363
Trade	(206,459)	(291,852)	(40,741)	(539,052)	(4,414,872)	230,320	67,424	297,744
Services	(181,390)	(249,618)	(33,066)	(464,074)	(4,265,982)	460,641	59,236	519,877

There is no Watershed Conservation Area under alternative 1.

| Alternative 2 | Agricultural Impacts | | | | Residential |
Watershed Conservation Area	Corn	Soybeans	Wheat	Total	Development Impacts
2030 Acreage Change	356	579	81	1,016	(1,016)
Spending	115,028	141,375	20,058	276,461	(18,663,294)
Total Impact on:					
Output	132,515	146,698	24,068	303,281	(20,366,736)
Personal Income	37,307	44,364	7,038	88,709	(6,750,304)
Employment	1	2	0	3	(325)
Output Impact of Selected Industries					
Fertilizer	31,089	18,415	3,900	53,404	0
Farm Machinery	13,990	21,589	4,654	40,233	0
Other Manufacturing	6,995	10,101	1,815	18,911	(767,080)
Trade	19,041	27,490	3,746	50,277	(5,547,360)
Services	16,710	23,070	3,113	42,893	(5,360,416)
2015 Acreage Change	138	225	32	395	(394)
Spending	44,607	54,825	7,925	107,357	(7,237,537)
Total Impact on:					
Output	51,389	56,889	9,333	117,611	(7,898,124)
Personal Income	14,467	17,205	2,729	34,401	(2,617,736)
Employment	1	1	0	2	(126)
Output Impact of Selected Industries					
Fertilizer	12,056	7,141	1,513	20,710	0
Farm Machinery	5,425	8,372	1,805	15,602	0
Other Manufacturing	2,712	3,917	704	7,333	(297,470)
Trade	7,384	10,661	1,453	19,498	(2,151,240)
Services	6,480	8,947	1,207	16,634	(2,078,744)

| Alternative 3 | Agricultural Impacts | | | | Residential |
Watershed Conservation Area	Corn	Soybeans	Wheat	Total	Development Impacts
2030 Acreage Change	370	603	85	1,058	(1,058)
Spending	119,783	147,218	21,364	288,365	(19,434,808)
Total Impact on:					
Output	137,993	152,763	25,064	315,820	(21,208,668)
Personal Income	38,847	46,198	7,330	92,375	(7,029,352)
Employment	1	2	1	4	(338)
Output Impact of Selected Industries					
Fertilizer	32,373	19,175	4,060	55,608	0
Farm Machinery	14,568	22,481	4,759	41,808	0
Other Manufacturing	7,284	10,519	1,891	19,694	(798,790)
Trade	19,829	28,627	3,901	52,357	(5,776,680)
Services	17,401	24,023	3,242	44,666	(5,582,008)
2015 Acreage Change	174	283	40	497	(497)
Spending	56,268	69,156	9,996	135,420	(9,129,584)
Total Impact on:					
Output	64,823	71,761	11,773	148,357	(9,962,862)
Personal Income	18,249	21,702	3,443	43,394	(3,302,068)
Employment	1	1	0	2	(159)
Output Impact of Selected Industries					
Fertilizer	15,208	9,008	1,908	26,124	0
Farm Machinery	6,843	10,561	2,276	19,680	0
Other Manufacturing	3,422	4,941	888	9,251	(375,235)
Trade	9,315	13,488	1,833	24,636	(2,713,620)
Services	8,174	11,285	1,522	20,981	(2,622,172)

Alternative 4	Agricultural Impacts				Residential
Watershed Conservation Area	**Corn**	**Soybeans**	**Wheat**	**Total**	**Development Impacts**
2030 Acreage Change	215	349	49	613	(613)
Spending	69,402	85,297	12,329	167,028	(11,260,432)
Total Impact on:					
Output	81,486	90,084	14,803	186,373	(12,530,333)
Personal Income	22,945	27,102	4,306	54,353	(4,149,511)
Employment	1	1	0	2	(210)
Output Impact of Selected Industries					
Fertilizer	19,128	11,110	2,354	32,592	0
Farm Machinery	8,557	13,025	2,868	24,450	0
Other Manufacturing	4,395	6,095	1,137	11,627	(472,185)
Trade	11,729	16,587	2,314	30,630	(3,412,757)
Services	10,305	14,181	1,879	26,365	(3,297,664)
2015 Acreage Change	83	135	19	236	(236)
Spending	26,719	32,839	4,746	64,304	(4,335,175)
Total Impact on:					
Output	31,371	34,681	5,698	71,750	(4,824,076)
Personal Income	8,833	10,434	1,658	20,925	(1,597,528)
Employment	0	0	0	0	(81)
Output Impact of Selected Industries					
Fertilizer	7,365	4,278	907	12,550	0
Farm Machinery	3,295	5,015	1,103	9,413	0
Other Manufacturing	1,693	2,346	437	4,476	(181,788)
Trade	4,516	6,386	891	11,793	(1,313,884)
Services	3,967	5,459	724	10,150	(1,269,574)

Appendix B1 Detailed Impacts Results for Farmland Preservation Plan Scenario

All amounts are 1998 dollars except acreage figures and employment which is number of jobs. These are annual figures for the year indicated. Although they will continue for the life of the alternative, in reality the local economy will adapt to the change over time. Since predicting future development entails a great deal of uncertainty, the use of two scenarios, the 1994 CP scenario and the FPP scenario, gives a greater likelihood that the impact estimates are based on reasonable assumptions about future conditions.

The figures have not been discounted. As there is no way to estimate the timing of impacts at this stage of planning showing present values of discounted time series would be misleading.

Although results are shown to the dollar, this does not imply accuracy at that level. Input-output analysis does not lend itself to calculation of formal confidence limits. As with Appendix B, these estimates should be used as a general indication of the overall magnitude of the impacts, not as a precise indicator of how each industry in the study area would be impacted by the scenario.

Note: It is assumed that refuge recreation takes place across the entire refuge. Therefore the total acreage figure under **Refuge Impacts** is the same as the acreage figure under Recreation.

Column sums may not equal column totals because of rounding

Alternative 1	Agricultural Impacts				Residential	Refuge Impacts		
Voluntary Purchase Area	Corn	Soybeans	Wheat	Total	Development Impacts	Recreation	Agriculture	Total
2030 Acreage Change	(7,827)	(12,747)	(1,789)	(22,364)	(690)	24,735	2,474	24,735
Spending	(2,335,258)	(3,333,606)	(450,384)	(6,119,248	(12,987,154)	2,305,154	609,519	2,914,673
Total Impact on:								
Output	(2,972,852)	(3,459,139)	(530,452)	(6,962,443	(14,172,522)	1,683,884	903,527	2,587,411
Personal Income	(837,080)	(1,046,111)	(155,132)	(2,038,323	(4,697,308)	594,312	254,366	848,678
Employment	(33)	(42)	(6)	(81)	(226)	22	10	32
Output Impact of Selected Industries								
Fertilizer	(697,836)	(434,198)	(85,948)	(1,217,982	0	0	211,971	211,971
Farm Machinery	(312,189)	(509,060)	(102,588)	(923,837)	0	0	95,387	95,387
Other Manufacturing	(160,365)	(238,180)	(40,035)	(438,580)	(533,785)	135,839	47,693	183,532
Trade	(427,920)	(648,227)	(82,571)	(1,158,718	(3,860,220)	452,797	129,832	582,629
Services	(375,958)	(543,977)	(68,621)	(988,556)	(3,730,132)	891,468	113,935	1,005,403

Alternative 1	Agricultural Impacts				Residential	Refuge Impacts		
Voluntary Purchase Area	Corn	Soybeans	Wheat	Total	Development Impacts	Recreation	Agriculture	Total
2015 Acreage Change	(4,692)	(7,642)	(1,073)	(13,407)	(407)	14,858	1,486	14,858
Spending	(1,517,889)	(1,865,558)	(269,663)	(3,653,110	(7,476,339)	1,383,111	359,296	1,742,407
Total Impact on:								
Output	(1,782,196)	(1,970,234)	(323,768)	(4,076,198	(8,319,487)	1,035,960	552,524	1,588,484
Personal Income	(501,822)	(592,760)	(94,190)	(1,188,772	(2,755,059)	365,382	155,576	520,958
Employment	(20)	(25)	(4)	(49)	(139)	24	6	30
Output Impact of Selected Industries								
Fertilizer	(418,346)	(242,987)	(51,460)	(712,793)	0	0	129,696	129,696
Farm Machinery	(187,154)	(284,880)	(62,717)	(534,751)	0	0	58,023	58,023
Other Manufacturing	(96,136)	(133,290)	(24,858)	(254,284)	(313,506)	81,504	29,805	111,309
Trade	(256,534)	(362,762)	(50,622)	(669,918)	(2,265,893)	271,682	79,532	351,214
Services	(225,383)	(310,159)	(41,086)	(576,628)	(2,189,476)	543,363	69,874	613,237

Alternative 2	Agricultural Impacts				Residential	Refuge Impacts		
Voluntary Purchase Area	**Corn**	**Soybeans**	**Wheat**	**Total**	**Development Impacts**	**Recreation**	**Agriculture**	**Total**
2030 Acreage Change	(7,079)	(11,529)	(1,618)	(20,226)	(712)	22,783	2,278	22,783
Spending	(2,289,910)	(2,814,408)	(406,818)	(5,511,136)	(13,079,001)	2,118,772	550,402	2,669,174
Total Impact on:								
Output	(2,638,038)	(2,920,390)	(479,142)	(6,037,570)	(14,272,752)	1,547,734	830,473	2,378,207
Personal Income	(742,674)	(883,183)	(140,126)	(1,765,983)	(4,730,528)	546,259	233,799	780,058
Employment	(27)	(35)	(6)	(68)	(228)	20	9	29
Output Impact of Selected Industries								
Fertilizer	(618,894)	(366,573)	(77,634)	(1,063,101)	0	0	194,832	194,832
Farm Machinery	(278,503)	(429,774)	(92,664)	(800,941)	0	0	87,674	87,674
Other Manufacturing	(139,251)	(201,083)	(36,162)	(376,496)	(537,560)	124,856	43,837	168,693
Trade	(379,073)	(547,268)	(74,583)	(1,000,924)	(3,887,520)	416,186	119,335	535,521
Services	(332,656)	(459,255)	(61,983)	(853,894)	(3,756,512)	819,389	104,722	924,111

Alternative 2	Agricultural Impacts				Residential	Refuge Impacts		
Voluntary Purchase Area	**Corn**	**Soybeans**	**Wheat**	**Total**	**Development Impacts**	**Recreation**	**Agriculture**	**Total**
2015 Acreage Change	(4,255)	(6,930)	(973)	(12,158)	(405)	13,656	1,366	13,656
Spending	(1,376,482)	(1,691,176)	(244,541)	(3,312,199)	(7,439,601)	1,271,263	330,240	1,601,503
Total Impact on:								
Output	(1,616,166)	(1,786,686)	(293,606)	(3,696,458)	(8,278,605)	952,185	507,843	1,460,028
Personal Income	(455,072)	(537,540)	(85,416)	(1,078,028)	(2,741,521)	335,835	142,996	478,831
Employment	(18)	(23)	(3)	(44)	(139)	22	5	27
Output Impact of Selected Industries								
Fertilizer	(379,372)	(220,350)	(46,666)	(646,388)	0	0	119,208	119,208
Farm Machinery	(169,719)	(258,341)	(56,874)	(484,934)	0	0	53,330	53,330
Other Manufacturing	(87,180)	(120,873)	(22,543)	(230,596)	(311,966)	74,913	27,394	102,307
Trade	(232,635)	(328,967)	(45,907)	(607,509)	(2,254,758)	249,712	73,100	322,812
Services	(204,386)	(281,265)	(37,259)	(522,910)	(2,178,717)	499,423	64,224	563,647

Alternative 3

Voluntary Purchase Area	Corn	Soybeans	Wheat	Total	Residential Development Impacts	Recreation	Agriculture	Total
	Agricultural Impacts				Residential	Refuge Impacts		
2030 Acreage Change	(6,536)	(10,644)	(1,494)	(18,674)	(711)	20,772	2,077	20,772
Spending	(2,114,198)	(2,598,451)	(375,602)	(5,088,251)	(13,060,632)	1,937,342	503,271	2,440,613
Total Impact on:								
Output	(2,435,614)	(2,696,301)	(442,376)	(5,574,291)	(14,252,706)	1,415,202	759,360	2,174,562
Personal Income	(685,686)	(815,413)	(129,374)	(1,630,473)	(4,723,884)	499,483	213,779	713,262
Employment	(25)	(33)	(4)	(62)	(227)	19	8	27
Output Impact of Selected Industries								
Fertilizer	(571,405)	(338,444)	(71,677)	(981,526)	0	0	178,149	178,149
Farm Machinery	(257,132)	(396,797)	(85,554)	(739,483)	0	0	80,167	80,167
Other Manufacturing	(128,566)	(185,654)	(33,387)	(347,607)	(536,805)	114,164	40,083	154,247
Trade	(349,985)	(505,275)	(68,860)	(924,120)	(3,882,060)	380,548	109,116	489,664
Services	(307,131)	(424,015)	(57,227)	(788,373)	(3,751,236)	749,225	95,755	844,980

Alternative 3

Voluntary Purchase Area	Corn	Soybeans	Wheat	Total	Residential Development Impacts	Recreation	Agriculture	Total
	Agricultural Impacts				Residential	Refuge Impacts		
2015 Acreage Change	(3,890)	(6,336)	(899)	(11,115)	(405)	12,487	1,249	12,487
Spending	(1,258,398)	(1,546,630)	(223,563)	(3,028,591)	(7,439,601)	1,162,405	301,963	1,464,368
Total Impact on:								
Output	(1,352,025)	(1,633,412)	(268,418)	(3,253,855)	(8,278,605)	870,650	464,356	1,335,006
Personal Income	(416,032)	(491,426)	(78,088)	(985,546)	(2,741,521)	307,077	130,750	437,827
Employment	(16)	(20)	(3)	(39)	(139)	20	5	25
Output Impact of Selected Industries								
Fertilizer	(346,827)	(201,446)	(42,663)	(590,936)	0	0	109,001	109,001
Farm Machinery	(155,160)	(236,179)	(51,995)	(443,334)	0	0	48,764	48,764
Other Manufacturing	(79,702)	(110,503)	(20,609)	(210,814)	(311,966)	68,499	25,049	93,548
Trade	(212,678)	(300,746)	(41,968)	(555,392)	2,254,758)	228,329	66,840	295,169
Services	(186,863)	(257,136)	(34,062)	(478,061)	(2,178,717)	456,658	58,725	515,383

Alternative 4	Agricultural Impacts				Residential	Refuge Impacts		
Voluntary Purchase Area	**Corn**	**Soybeans**	**Wheat**	**Total**	**Development Impacts**	**Recreation**	**Agriculture**	**Total**
2030 Acreage Change	(6,518)	(10,615)	(1,490)	(18,622)	(711)	21,016	2,102	21,016
Spending	(2,108,311)	(2,591,215)	(374,556)	(5,074,082)	(12,711,614)	1,956,351	508,209	2,464,560
Total Impact on:								
Output	(2,475,426)	(2,736,608)	(449,706)	(5,661,740)	(14,145,172)	1,465,321	781,522	2,246,843
Personal Income	(697,018)	(823,331)	(130,828)	(1,651,177)	(4,684,277)	516,817	220,079	736,896
Employment	(27)	(35)	(6)	(68)	(237)	20	9	29
Output Impact of Selected Industries								
Fertilizer	(581,072)	(337,503)	(71,477)	(990,052)	0	0	183,452	183,452
Farm Machinery	(259,953)	(395,692)	(87,113)	(742,758)	0	0	82,070	82,070
Other Manufacturing	(133,532)	(185,137)	(34,528)	(353,197)	(533,038)	115,285	42,158	157,443
Trade	(356,319)	(503,868)	(70,314)	(930,501)	(3,852,574)	384,282	112,494	496,776
Services	(313,052)	(430,804)	(58,465)	(802,321)	(3,722,648)	768,564	98,834	867,398

Alternative 4	Agricultural Impacts				Residential	Refuge Impacts		
Voluntary Purchase Area	**Corn**	**Soybeans**	**Wheat**	**Total**	**Development Impacts**	**Recreation**	**Agriculture**	**Total**
2015 Acreage Change	(3,776)	(6,150)	(863)	(10,790)	(407)	6,759	676	6,759
Spending	(1,221,602)	(1,501,408)	(217,026)	(2,940,036)	(7,476,339)	629,186	163,446	792,632
Total Impact on:								
Output	(1,434,318)	(1,585,651)	(260,569)	(3,280,538)	(8,319,487)	471,265	251,347	722,612
Personal Income	(403,868)	(477,056)	(75,805)	(956,729)	(2,755,059)	166,215	70,773	236,988
Employment	(15)	(20)	(3)	(38)	(139)	11	3	14
Output Impact of Selected Industries								
Fertilizer	(336,685)	(195,556)	(41,416)	(573,657)	0	0	56,000	56,000
Farm Machinery	(150,622)	(229,273)	(50,475)	(430,370)	0	0	26,395	26,395
Other Manufacturing	(77,372)	(107,273)	(20,006)	(204,651)	(313,506)	37,077	13,558	50,635
Trade	(206,459)	(291,952)	(40,741)	(539,152)	2,265,893)	123,590	36,180	159,770
Services	(181,390)	(249,618)	(33,066)	(464,074)	(2,189,476)	247,179	31,786	278,965

There is no Watershed Conservation Area under Alternative 1.

Alternative 2

| Watershed Conservation Area | Agricultural Impacts | | | | Residential |
	Corn	Soybeans	Wheat	Total	Development Impacts
2030 Acreage Change	204	332	47	582	(582)
Spending	65,891	80,984	11,706	158,581	(10,690,981)
Total Impact on:					
Output	77,365	85,527	14,054	176,946	(11,896,662)
Personal Income	21,784	25,732	4,088	51,604	(3,939,667)
Employment	1	1	0	2	(199)
Output Impact of Selected Industries					
Fertilizer	18,160	10,548	2,233	30,941	0
Farm Machinery	8,124	12,366	2,722	23,212	0
Other Manufacturing	4,173	5,786	1,080	11,039	(448,307)
Trade	11,136	15,747	2,197	29,080	(3,240,171)
Services	9,784	13,464	1,784	25,032	(3,130,898)

Alternative 2

| Watershed Conservation Area | Agricultural Impacts | | | | Residential |
	Corn	Soybeans	Wheat	Total	Development Impacts
2015 Acreage Change	138	225	32	394	(394)
Spending	44,606	54,825	7,925	107,356	(7,237,537)
Total Impact on:					
Output	52,374	57,900	9,515	119,789	(8,053,754)
Personal Income	14,748	17,420	2,768	34,936	(2,667,059)
Employment	1	1	0	2	(135)
Output Impact of Selected Industries					
Fertilizer	12,294	7,140	1,397	20,831	0
Farm Machinery	5,500	8,372	1,844	15,716	0
Other Manufacturing	2,825	3,917	731	7,473	(303,493)
Trade	7,539	10,661	1,488	19,688	(2,193,518)
Services	6,624	9,115	1,207	16,946	(2,119,542)

| Alternative 3 | Agricultural Impacts | | | | Residential |
Watershed Conservation Area	Corn	Soybeans	Wheat	Total	Development Impacts
2030 Acreage Change	204	332	47	583	(582)
Spending	65,891	80,984	11,706	158,581	(10,690,981)
Total Impact on:					
Output	77,365	85,529	14,054	176,948	(11,896,662)
Personal Income	21,784	25,732	4,088	51,604	(3,939,667)
Employment	1	1	1	3	(199)
Output Impact of Selected Industries					
Fertilizer	18,160	10,548	2,233	30,941	0
Farm Machinery	8,124	12,366	2,722	23,212	0
Other Manufacturing	4,173	5,786	1,080	11,039	(448,307)
Trade	11,136	15,747	2,197	29,080	(3,240,171)
Services	9,784	13,464	1,784	25,032	(3,130,898)

| Alternative 3 | Agricultural Impacts | | | | Residential |
Watershed Conservation Area	Corn	Soybeans	Wheat	Total	Development Impacts
2015 Acreage Change	174	283	40	497	(497)
Spending	56,268	69,156	9,996	135,420	(9,129,584)
Total Impact on:					
Output	66,066	73,037	12,002	151,105	(10,159,177)
Personal Income	18,603	21,978	3,492	44,073	(3,364,286)
Employment	1	1	1	3	(170)
Output Impact of Selected Industries					
Fertilizer	15,508	9,008	1,908	26,424	0
Farm Machinery	6,938	10,561	2,326	19,825	0
Other Manufacturing	3,563	4,941	922	9,426	(382,832)
Trade	9,510	13,448	1,877	24,835	(2,766,950)
Services	8,354	11,498	1,522	21,374	(2,673,636)

| Alternative 4 | Agricultural Impacts | | | | Residential |
Watershed Conservation Area	Corn	Soybeans	Wheat	Total	Development Impacts
2030 Acreage Change	120	196	27	343	(343)
Spending	38,833	47,728	6,897	93,458	(6,300,699)
Total Impact on:					
Output	45,594	50,406	8,282	104,282	(7,011,263)
Personal Income	12,838	15,165	2,409	30,412	(2,321,831)
Employment	0	1	0	1	(117)
Output Impact of Selected Industries					
Fertilizer	10,703	6,216	1,317	18,236	0
Farm Machinery	4,788	7,287	1,605	13,680	0
Other Manufacturing	2,460	3,410	636	6,506	(264,208)
Trade	6,563	9,280	1,295	17,138	(1,909,585)
Services	5,766	7,935	1,051	14,752	(1,845,185)

| Alternative 4 | Agricultural Impacts | | | | Residential |
Watershed Conservation Area	Corn	Soybeans	Wheat	Total	Development Impacts
2015 Acreage Change	83	135	19	237	(236)
Spending	26,719	32,837	4,746	64,302	(4,335,175)
Total Impact on:					
Output	31,372	34,681	5,699	71,752	(4,824,076)
Personal Income	8,833	10,434	1,658	20,925	(1,597,528)
Employment	0	0	0	0	(81)
Output Impact of Selected Industries					
Fertilizer	7,365	4,277	907	12,549	0
Farm Machinery	3,295	5,015	1,103	9,413	0
Other Manufacturing	1,692	2,346	437	4,475	(181,788)
Trade	4,516	6,386	891	11,793	(1,313,884)
Services	3,967	5,459	723	10,149	(1,269,574)

Ohio's Current Agricultural Use Value (CAUV) program allows active agricultural land to be appraised by soil type rather than by the full market value of the land. The program is intended to preserve farmland by eliminating the escalation in taxes as the value of the land for alternative uses increases. In 1997, for example, the taxable value of 269,391 acres in Madison County would have been $122 million in other uses but was $41 million under agricultural use (Ohio Department of Taxation).

Because they are federally owned lands, National Wildlife Refuges are not subject to local property taxes. To mitigate the impact of this exemption on local tax collections, Congress has established the Refuge Revenue Sharing program (RRS) which distributes revenues from refuge resource use and a federal appropriation to refuge host communities (U.S. Department of the Interior, Fish and Wildlife Service 1999b). Only lands owned in fee title by the Fish and Wildlife Service are included in RRS. There would be no RRS payment for lands in the Watershed Conservation Area where purchase of development rights and easements are planned. Although such encumbrances reduce the market value of land, they would not affect the CAUV assessment which is based solely on soil type.

Although there are three methods of calculating RRS payments, the payment is usually three-quarters of one percent (0.75 percent) of the fair market value of refuge lands. Refuge resources do not generate enough revenue to pay all of the calculated payments due. Congress annually appropriates some funds to reduce the shortfall but available funds have still fallen short of calculated amounts by 7 to 40 percent in the 1990's. When funds are inadequate, payments are prorated to the extent of available funds. In recent years, payments have been prorated from 60 to 93 percent of the calculated payment due. In some regions of the country, refuge revenue sharing payments are greater than property tax revenues would have been from the same property. More often revenue sharing payments fall somewhat short of anticipated revenues.

Madison County

Exhibit C-1 shows the assumptions used to compare tax revenues from the Current Agricultural Use Valuation (CAUV) assessment with revenue sharing payments from the Refuge Revenue Sharing program (RRS) for Madison County. CAUV values and acreage by soil type were provided by the Madison County Auditor's office for use in 1999. Statistics from the Ohio Department of Taxation indicate that CAUV values are about one-third of "highest and best use" values. Market value was estimated by multiplying the CAUV for each soil type by 2.985, the ratio of "best use" value to CAUV in 1997. These estimated values agree well with the 1997 Census of Agriculture which found the average market value per acre of farm land and buildings was $2,033 in Madison county and $2,271 in Union county. Obviously differences in soil quality affect value. To estimate the RRS payment, the market value is multiplied by the 0.0075 statutory payment rate and the result is pro-rated to 70 percent because of a presumed lack of funds. Seventy percent is roughly the average rate of pro-ration in the 1990's.

Exhibit C-1. Values by Soil Type, Madison County, 1999.				
Soil Type		**Total**	**CAUV Value**	**Market Value**
Symbol	**Description**	**Acres**	**$/acre**	**$/acre**
Ca	Carlisle Muck	160	640	1,910
CrA	Crosby silt loam, 0-2%	3,817	560	1,672
CrB	Crosby silt loam, 2-6%	402	490	1,463
CsA	Crosby Lewisburg silt loam, 0-2%	48,620	450	1,343
CsB	Crosby Lewisburg silt loam, 2-6%	77,676	420	1,254
ElA	Eldean silt loam, 0-2%	697	390	1,164
ElB	Eldean silt loam, 2-6%	3,864	330	985
ElC2	Eldean silt loam, 6-12%, eroded	436	240	716
KeB	Kendallville silt loam, 2-6%	948	410	1,224
KeC2	Kendallville silt loam, 6-12%	188	210	627
Ko	Kokomo silty clay loam	97,467	840	2,507
LeB	Lewisburg-Celina silt loam, 2-6%	19,555	360	1,075
Mk	Medway silt loam, occasionally flooded	2,612	700	2,090
MiB	Miamian silt loam, 2-6%	3,262	490	1,463
MiC2	Miamian silt loam, 6-12%, eroded	7,084	350	1,045
MiD2	Miamian silt loam, 12-18%, eroded	2,831	170	507
MiE2	Miamian silt loam, 18-25%, eroded	872	100	299
MiF	Miamian silt loam, 25-50%	715	100	299
MnB	Miamian-Eldean silt loams, 2-6%	2,364	370	1,104
MnC2	Miamian-Eldean silt loams, 6-12%, eroded	806	170	507
OdA	Odell-Lewisburg complex, 0-2%	2,226	770	2,299
OdB	Odell-Lewisburg complex, 2-6%	557	710	2,119
Pa	Patton silty clay loam	1,120	600	1,791
Pg	Pits, gravel	340	50	149
Rs	Ross silt loam, occasionally flooded	987	850	2,537
So	Sloan silty clay loam, frequently flooded	6,899	650	1,940
ThA	Thackery Variant silt loam, 0-2%	281	460	1,373
ThB	Thackery Variant silt loam, 2-6%	207	420	1,254
WeA	Wea silt loam, 0-3%	330	700	2,090
Wt	Westland silty clay loam	5,058	920	2,746
Wv	Westland silty clay loam, silty substratum	3,650	770	2,299
W	Water	289	50	149
		296,320		
source: Madison County Auditor and FWS/Division of Economics Calculation				

Each jurisdiction within Madison county (made up of overlapping county, township, school, EMS, and fire districts) has its own tax rate and reduction factor. The rate and reduction factor depend on the total valuation of the jurisdiction and the rates of levies approved by voters in the jurisdiction. Taken together the tax rate and reduction factor imply an effective rate of taxation for each jurisdiction. Showing a comparison for each jurisdiction would be misleading as we do not know the timing and location of refuge acquisitions from willing sellers nor the future development of each jurisdiction which will change total valuation and therefore tax rates. Instead we show the comparison for the lowest and highest effective tax rates in the five township area of the proposed refuge for 1999, the last year for which Madison county tax information is complete. For each alternative refuge proposal, all of the land in the voluntary purchase area was classified by soil type and the acreage of each type calculated. These estimates show the range of annual effects when the refuge is complete in 30 years.

The basic formula for taxes due from CAUV agricultural land is:

$$T = A \times S \times 0.35 \times t_J \times (1 - R_J) \times (1 - R_S)$$

where: T= Real property taxes due for parcel of a single soil type (dollars)
    A= Acreage of parcel (acres)
    S= CAU Valuation for soil type of parcel (dollars per acre)
    0.35= Valuation rate (taxable dollars per dollar of raw valuation)
    t_J= Tax assessment rate for the jurisdiction (dollars of tax per dollar of taxable valuation)
    R_J= Reduction factor for the jurisdiction
    R_S= Reduction factor for the state, 0.10 in 1999.

The fourth column of Exhibit C-1 shows S for each soil type. The "Acres" column in the following exhibits shows A by alternative. As explained above, the tax rates for two jurisdictions in the proposed refuge neighborhood were used in the following tables to compare RRS with local tax rates.

The formula for RRS payments is simpler:

$$RRS = A \times S \times C \times 0.0075 \times P$$

where: RRS= Refuge Revenue Sharing payment for a parcel of a single soil type (dollars)
    A= Acreage of parcel (acres)
    S= CAU Valuation for soil type of parcel (dollars per acre)
    C= Conversion factor from CAUV to fair market value, 2.985 for Madison, 3.0 for Union
    0.0075= the statutory payment rate for the RRS program (dollars payment per dollar of fair market valuation)
    P= Pro-rating factor for limited funding, 1990's average is 0.70.
The last column of Exhibit C-1 shows SxC.

Exhibit C-2 compares the revenue expected from refuge revenue sharing and CAUV taxes using Jefferson township's tax rates, the highest effective tax rates among the nearby jurisdictions for 1999, for each refuge alternative. The rate is 48.62 mills, $0.04832 per dollar of value (t_J=0.0558, R_J=0.128680). For each alternative, refuge revenue sharing provides about 2 percent <u>more</u> revenue to the highest taxed jurisdiction than CAUV property taxes.

Exhibit C-3 compares RRS payments and CAUV tax collection using the rates of Deercreek township which has the lowest effective tax rates in the area, 37.87 mills (t_J=0.0541, R_J=0..300066). The RRS payment is unchanged but CAUV revenues are much lower. RRS payments are 31 percent higher than CAUV revenues at these rates.

Exhibit C-2. Maximum Tax Rate Jurisdiction by Soil Type, Jefferson Township, Madison County, 1999 rates.												
	Alternative 1			Alternative 2			Alternative 3			Alternative 4		
Description	Acres	CAUV Tax	RRS Payment	Acres	CAUV Tax	RRS Payment	Acres	CAUV Tax	RRS Payment	Acres	CAUV Tax	RRS Payment
Carlisle Muck	1	10	10	2	20	20	1	10	10	2	20	20
Crosby silt loam, 0-2%	171	1,467	1,501	173	1,484	1,518	48	412	421	174	1,492	1,527
Crosby silt loam, 2-6%	48	360	369	50	375	384	45	338	346	49	368	376
Crosby Lewisburg silt loam, 0-2%	4,607	37,751	32,490	2894	19,945	20,409	4267	29,407	30,092	2,681	18,477	18,907
Crosby Lewisburg silt loam, 2-6%	5,968	38,388	39,282	5616	36,124	36,965	3146	20,236	20,707	5,526	35,545	36,373
Eldean silt loam, 0-2%	15	90	92	15	90	92	15	90	92	15	90	92
Eldean silt loam, 2-6%	427	2,158	2,208	427	2,158	2,208	282	1,425	1,458	424	2,143	2,193
Eldean silt loam, 6-12%, eroded	81	298	305	81	298	305	62	228	233	80	294	301
Kendallville silt loam, 2-6%	0	0	0	14	88	90	0	0	0	0	0	0
Kendallville silt loam, 6-12%	7,815	0	0	0	0	0	0	0	0	0	0	0
Kokomo silty clay loam	1,532	100,538	102,878	5676	73,020	74,720	5904	75,954	77,721	5,374	69,135	70,744
Lewisburg-Celina silt loam, 2-6%	34	8,447	8,643	1462	8,061	8,248	1185	6,533	6,686	1,402	7,730	7,910
Medway silt loam, occ flooded	17	365	373	34	365	373	34	365	373	34	365	373
Miamian silt loam, 2-6%	613	128	131	33	248	253	17	128	131	17	128	131
Miamian silt loam, 6-12%, eroded	339	3,286	3,362	642	3,441	3,521	481	2,578	2,638	602	3,227	3,302
Miamian silt loam, 12-18%, eroded	10	883	903	340	885	906	218	568	581	339	883	903
Miamian silt loam, 18-25%, eroded	1	15	16	10	15	16	10	15	16	11	17	17
Miamian silt loam, 25-50%	61	2	2	2	3	3	1	2	2	1	2	2
Miamian-Eldean silt loams, 2-6%	1	346	354	83	470	481	32	181	186	46	261	267
Miamian-Eldean silt loams, 6-12%	286	3	3	2	5	5	1	3	3	1	3	3
Odell-Lewisburg complex, 0-2%	13	3,373	3,451	66	778	796	357	4,210	4,308	167	1,969	2,015
Odell-Lewisburg complex, 2-6%	20	141	145	22	239	245	13	141	145	13	141	145
Patton silty clay loam	12	184	188	20	184	188	148	1,360	1,392	19	175	179
Pits, gravel	22	9	9	14	11	11	8	6	6	12	9	9
Ross silt loam, occ flooded	1,090	286	293	22	286	293	22	286	293	22	286	293
Sloan silty clay loam, freq flooded	8	10,851	11,103	1,155	11,498	11,765	857	8,531	8,730	965	9,606	9,830
Thackery Variant silt loam, 0-2%	499	56	58	8	56	58	8	56	58	8	56	58
Thackery Variant silt loam, 2-6%	6	0	0	0	0	0	0	0	0	0	0	0
Wea silt loam, 0-3%	23,697	0	0	0	0	0	0	0	0	0	0	0
Westland silty clay loam	499	7,031	7,195	498	7,017	7,180	222	2,318	3,201	497	7,003	7,166
Westland silty clay lm, silty subst	0	0	0	0	0	0	0	0	0	0	0	0
Water	6	5	5	6	5	5	4	3	3	6	5	5
Total	23,697	210,468	215,366	19,367	167,169	171,060	17,388	156,194	159,829	18,487	159,428	163,138

source: FWS/Division of Economics calculation

Exhibit C-3. Minimum Tax Rate Jurisdiction by Soil Type, Deercreek Township, Madison County, 1999 rates.

Description	Alternative 1 Acres	CAUV Tax	RRS Payment	Alternative 2 Acres	CAUV Tax	RRS Payment	Alternative 3 Acres	CAUV Tax	RRS Payment	Alternative 4 Acres	CAUV Tax	RRS Payment
Carlisle Muck	1	8	10	2	15	20	1	8	10	2	15	20
Crosby silt loam, 0-2%	171	1,142	1,501	173	1,156	1,518	48	321	421	174	1,162	1,527
Crosby silt loam, 2-6%	48	281	369	50	292	384	45	263	346	49	286	376
Crosby Lewisburg silt loam, 0-2%	4,607	24,728	32,490	2,894	15,534	20,409	4,267	22,903	30,092	2,681	14,390	18,907
Crosby Lewisburg silt loam, 2-6%	5,968	29,898	39,282	5,616	28,135	36,965	3,146	15,761	20,707	5,526	27,684	36,373
Eldean silt loam, 0-2%	15	70	92	15	70	92	15	70	92	15	70	92
Eldean silt loam, 2-6%	427	1,681	2,208	427	1,681	2,208	282	1,110	1,458	424	1,669	2,193
Eldean silt loam, 6-12%, eroded	81	232	305	81	232	305	62	177	233	80	229	301
Kendallville silt loam, 2-6%	0	0	0	14	68	90	0	0	0	0	0	0
Kendallville silt loam, 6-12%	0	0	0	0	0	0	0	0	0	0	0	0
Kokomo silty clay loam	7,815	78,302	102,878	5,676	56,870	74,720	5,904	59,155	77,721	5,374	53,845	70,744
Lewisburg-Celina silt loam, 2-6%	1,532	6,578	8,643	1,462	6,278	8,248	1,185	5,088	6,686	1,402	6,020	7,910
Medway silt loam, occ flooded	34	284	373	34	284	373	34	284	373	34	284	373
Miamian silt loam, 2-6%	17	99	131	33	193	253	17	99	131	17	99	131
Miamian silt loam, 6-12%, eroded	613	2,669	3,362	642	2,680	3,521	481	2,008	2,638	602	2,513	3,302
Miamian silt loam, 12-18%, eroded	339	687	903	340	689	906	218	442	581	339	687	903
Miamian silt loam, 18-25%, eroded	10	12	16	10	12	16	10	12	16	11	13	17
Miamian silt loam, 25-50%	1	1	2	2	2	3	1	1	2	1	1	2
Miamian-Eldean silt loams, 2-6%	61	269	354	83	366	481	32	141	186	46	203	267
Miamian-Eldean silt loams, 6-12%	1	2	3	2	4	5	1	2	3	1	2	3
Odell-Lewisburg complex, 0-2%	286	2,627	3,451	66	606	796	357	3,279	4,308	167	1,534	2,015
Odell-Lewisburg complex, 2-6%	13	110	145	22	186	245	13	110	145	13	110	145
Patton silty clay loam	20	143	188	20	143	188	148	1,059	1,392	19	136	179
Pits, gravel	12	7	9	14	8	11	8	5	6	12	7	9
Ross silt loam, occ flooded	22	223	293	22	223	293	22	223	293	22	223	293
Sloan silty clay loam, freq flooded	1,090	8,451	11,103	1,155	8,955	11,765	857	6,644	8,730	965	7,482	9,830
Thackery Variant silt loam, 0-2%	8	44	58	8	44	58	8	44	58	8	44	58
Thackery Variant silt loam, 2-6%	0	0	0	0	0	0	0	0	0	0	0	0
Wea silt loam, 0-3%	0	0	0	0	0	0	0	0	0	0	0	0
Westland silty clay loam	499	5,476	7,195	498	5,465	7,180	222	2,436	3,201	497	5,454	7,166
Westland silty clay lm, silty subst	0	0	0	0	0	0	0	0	0	0	0	0
Water	6	4	5	6	4	5	4	2	3	6	4	5
Total	23,697	163,918	215,366	$19,367	130,196	171,060	17,388	121,648	159,829	18,487	124,167	163,138

source: FWS/Division of Economics calculation

Union County

The comparison for Union county is similar to that for Madison. Exhibit C-4 shows the CAU value and market value for Union county. Union county's ratio of highest and best use value to CAU value is 3.0. All of the assumptions and calculations are the same as for the Madison county examples.

Exhibit C-4. Values by Soil Type, Union County, 1999.		CAU Value	Market Value
Soil Type			
Symbol	**Description**	**$/acre**	**$/acre**
Bs	Brookston silty clay loam	790	2,372
CeB	Celina silt loam	500	1,502
CrA	Crosby silt loam, 0-2%	560	1,682
CrB	Crosby silt loam, 2-6%	490	1,471
FoB	Fox silt loam	220	661
KeA	Kendallville silt loam, 0-2%	420	1,261
KeB	Kendallville silt loam, 2-6%	410	1,231
Lc	Lippincott silty clay loam	590	1,772
MiB	Miamian silt loam, 2-6%	480	1,441
MrB	Morley silt loam	380	1,141
Mu	Mukego muck	370	1,111
OdA	Odell-Lewisburg complex, 0-2%	730	2,192
So	Sloan silty clay loam, frequently flooded	460	1,381
source: Union County Auditor and FWS/Division of Economics Calculation			

There are only three jurisdictions in the voluntary purchase area in Union county. Exhibit C-5 shows a comparison of CAUV revenues to RRS payments for the highest effective tax rate jurisdiction, Darby-Fairbanks-Pleasant Valley. RRS yields 2 percent more revenue than the CAUV assessment.

Exhibit C-6 compares CAUV revenues with RRS payments for the jurisdiction with the lowest effective tax rate in the affected area of Union county, Darby-Fairbanks. The RRS payment is 31 percent higher than CAUV revenues from the land in the voluntary purchase area.

Exhibit C-5. Maximum Tax Rate Jurisdiction by Soil Type, Darby-Fairbanks-Pleasant Valley, Union County, 1999 rates.

Description	Alternative 1 Acres	CAUV Tax	RRS Payment	Alternative 2 Acres	CAUV Tax	RRS Payment	Alternative 3 Acres	CAUV Tax	RRS Payment	Acres	CAUV Tax	RRS Payment
Brookston silty clay loam	569	$6,935	$7,087	1291	$15,734	$16,079	1752	$21,353	$21,821	1221	14881	15207
Celina silt loam	18	139	142	94	725	741	88	679	694	64	494	505
Crosby silt loam, 0-2%	262	2,264	2,313	841	7,266	7,425	1026	8,864	9,058	706	6099	6233
Crosby silt loam, 2-6%	18	136	139	149	1,126	1,151	168	1,270	1,298	134	1013	1035
Fox silt loam	5	17	17	5	17	17	5	17	17	5	17	17
Kendallville silt loam, 0-2%	15	97	99	15	97	99	15	97	99	15	97	99
Kendallville silt loam, 2-6%	16	101	103	11	70	71	16	101	103	16	101	103
Lippincott silty clay loam	29	264	270	28	255	260	29	264	270	29	264	270
Miamian silt loam, 2-6%	0	0	0	25	185	189	16	118	121	16	118	121
Morley silt loam	0	0	0	18	106	108	13	76	78	5	29	30
Mukego muck	13	74	76	13	74	76	13	74	76	13	74	76
Odell-Lewisburg complex, 0-2%	5	56	58	12	135	138	19	214	219	5	56	58
Sloan silty clay loam, freq flooded	106	752	769	373	2,647	2,705	297	2,108	2,154	244	1732	1770
Total	1,056	$10,835	$11,073	2,875	$28,437	$29,061	3,457	$35,236	$36,008	2,473	24,977	25,524

source: FWS/Division of Economics calculation

Exhibit C-6. Minimum Tax Rate Jurisdiction by Soil Type, Darby-Fairbanks, Union County, 1999 rates.

Description	Alternative 1 Acres	CAUV Tax	RRS Payment	Alternative 2 Acres	CAUV Tax	RRS Payment	Alternative 3 Acres	CAUV Tax	RRS Payment	Acres	CAUV Tax	RRS Payment
Brookston silty clay loam	569	$5,421	$7,087	1291	$12,300	$16,079	1752	$16,692	$21,821	1,221	11,633	15,207
Celina silt loam	18	109	142	94	567	741	88	531	694	64	386	505
Crosby silt loam, 0-2%	262	1,769	2,313	841	5,680	7,425	1026	6,929	9,058	706	4,768	6,233
Crosby silt loam, 2-6%	18	106	139	149	880	1,151	168	993	1,298	134	792	1,035
Fox silt loam	5	13	17	5	13	17	5	13	17	5	13	17
Kendallville silt loam, 0-2%	15	76	99	15	76	99	15	76	99	15	76	99
Kendallville silt loam, 2-6%	16	79	103	11	54	71	16	79	103	16	79	103
Lippincott silty clay loam	29	206	270	28	199	260	29	206	270	29	206	270
Miamian silt loam, 2-6%	0	0	0	25	145	189	16	93	121	16	93	121
Morley silt loam	0	0	0	18	82	108	13	60	78	5	23	30
Mukego muck	13	58	76	13	58	76	13	58	76	13	58	76
Odell-Lewisburg complex, 0-2%	5	44	58	12	106	138	19	167	219	5	44	58
Sloan silty clay loam, freq flooded	106	588	769	373	2,069	2,705	297	1,648	2,154	244	1,354	1,770
Total	1,056	$8,470	$11,073	2,875	$22,230	$29,061	3,457	$27,544	$36,008	2,473	19,524	25,524

source: FWS/Division of Economics calculation

Appendix D. County Revenue Impacts

Tables 1 through 4 show various land use and assessment data for the five townships of Canaan, Deer Creek, Monroe, Pike, Darby and Somerford along with some intermediate calculations used to obtain the estimates in the text. Basically, the estimates were calculated as follows:

(1) lost revenue: residential structures:

Cols. d, e, and f in Table 1 provided the basic assessment information used in the estimates. Col. f shows the residential building assessment per non-vacant parcel. Table 2 col. h shows the residential and agriculture millage rate for the respective township. The Jonathan Alder school district rate of 24.59 mills is subtracted from this column to get a net millage rate (in order to get an estimate of county revenues over and above any school district revenues). Col. k simply converts the millage rate to a percentage, which is then multiplied by col. f to obtain county revenue per residential parcel (which have residential structures). Here it is assumed that each residence consists of one parcel. The county revenue per parcel figure is then multiplied by the number of residences affected within the respective township (it is assumed that the number of houses purchased in each township will be in the same proportion as the number of houses in each township in the VPA is to the total number of houses in the VPA. For example, Canaan Township has 2.2 percent of the total number of houses in the VPA. Consequently, it is expected that 2.2 percent of Service purchases will be in Canaan Township).

(2) lost revenue: conversion of residential land to agriculture land (for assessment purposes):

Table 3 estimates residential and agricultural land value per acre. The difference between these two land values is the lost assessed value per acre from the transition from residential to agricultural land. This is shown in col. 1 in Table 4. Col. 2 shows the number of acres per residential parcel. If it is assumed that each residence consists of one parcel, and that the average number of assessed residential acres per parcel for each residence the Service purchases is the same as that for the township as a whole (col. 2), then multiplying cols. 1 and 2 gives the assessed land value lost per residence purchased by the Service. Multiplying this value (col. 3) by the millage rate (converted to percent) gives county revenue lost per residence purchased by the Service. This figure in turn is multiplied by the high and low purchase estimates to get total county revenue lost due to the conversion of residential land to agricultural land.

	(a)	(b)	(c)	(d)	(e)	(f)
Appendix D. Table 1 Madison County 1999 Assessment Information						
Township	Non-Vacant Agriculture Parcels	Agriculture building assessment	Agriculture building assessment per non-vacant parcel *(b) / (a)*	Non-vacant residential parcels	Residential building assessment	residential building assessment per non-vacant parcel *(e) / (d)*
Canaan	131	$4,152,680	$31,700	401	$15,908,340	$39,672
Deer Creek	74	$1,582,030	$21,379	248	$6,772,130	$27,307
Monroe	66	$1,455,740	$22,057	269	$7,420,550	$27,586
Pike	62	$1,696,030	$27,355	83	$2,109,530	$25,416
Darby	75	$2,193,050	$29,241	168	$5,730,200	$34,108
Somerford	62	$1,482,590	$23,913	1,088	$36,715,940	$33,746
Total	470	$12,562,120	$26,728	2,257	$74,656,690	$33,078

source: Madison County Auditor's Office. 1999

Township	(h) Residential/ agriculture millage rate	(i) Jonathan Alder school district millage	(j) Madison County revenue millage (h) - (i)	(k) Percent of assessed value (j) / (1,000)	(l) County revenue per residential parcel (k)* (f)	(m) Low estimate of residences affected (135)	(n) High estimate of residences affected (202)	(o) Low estimate of county revenue lost (l)* (m)	(p) High estimate of county revenue lost (l) * (n)
Canaan	44.25	24.59	19.66	1.97 %	$780	2.4	3.6	$1,895	$2,836
Deer Creek	38.32	24.59	13.73	1.37 %	$375	12.7	19.9	$4,758	$7,119
Monroe	38.56	24.59	13.97	1.40%	$385	104.6	156.6	$40,320	$60,330
Pike	38.35	24.59	13.76	1.38%	$350	7.6	11.3	$2,644	$3,956
Darby	45.26	24.59	20.67	2.07%	$705	6.6	9.9	$4,664	$6,978
Somerford	38.53	24.59	13.94	1.39%	$470	0.9	1.4	$445	$665
Total						**135**	**202**	**$54,726**	**$81,884**

Appendix D. Table 2. Estimated Madison County Revenue Impacts.

	(a)	(b)	(c)	(d)	(e)	(f)
Township	Residential land value	Total residential acres	Residential land value per acre (a) / (b)	Agriculture land value	Total agriculture land acreage	Agriculture land value per acre (d) / (e)
Canaan	$4,229,070	1,178	$3,590	$5,067,600	20,562	$246
Deer Creek	$1,643,330	439	$3,743	$2,574,910	11,712	$220
Monroe	$2,009,830	1,083	$1,856	$2,579,000	13,366	$193
Pike	$451,520	262	$1,723	$3,688,590	16,278	$227
Darby	$1,130,800	419	$2,699	$2,831,700	10,787	$263
Somerford	$16,119,410	1,344	$11,994	$1,860,390	10,107	$184
totals/average	$25,583,960	4,725	$5,415	$18,602,190	82,812	$225

Appendix D. Table 3. Residential and Agriculture Land Assessment Information, Madison County 1999.

Table 4. Estimated Loss of County Revenue from Conversion of Residential Land to Unimproved Agriculture Land. 1999

Township	(1) loss per acre assessed value (c) - (f)	(2) residential acres per parcel	(3) assessed residential land value loss per residence (1) * (2)	(4) Percent of assessed value	(5) County revenue lost per residence (3) * (4)	(6) Low estimate of residences affected (135)	(7) High estimate of residences affected (202)	(8) Low estimate of county revenue lost (5) * (6)	(9) High estimate of county revenue lost (5) * (7)
Canaan	$3,344	2.1	$7,022	1.97	$139	2.4	3.6	$334	$500
Deer Creek	$3,523	1.4	$4,932	1.37	$67	12.7	19.0	$851	$1,273
Monroe	$1,663	2.7	$4,490	1.40	$62	104.6	156.6	$6,514	$9,752
Pike	$1,497	2.3	$3,443	1.38	$48	7.6	11.3	$366	$544
Darby	$2,436	1.7	$4,141	2.07	$86	6.6	9.9	$571	$856
Somerford	$11,810	0.9	$10,629	1.39	$149	0.9	1.4	$134	$209
total						135	202	$8,770	$13,134

Appendix E. Estimate of Farmland Preservation Plan (FPP) Impacts on Residential Development

Tables 1, 2 and 3 show the basic information and calculations used to estimate the baseline amount of residential development under the Farmland Preservation Plan (**FPP**). Since it is not known how much development would actually take place under the FPP, it is assumed, as a conservative estimate, that future development will be similar to the historic annual average of new residential development in the study area townships. Using this assumption acknowledges the fact that some development will take place, but at a lower rate then what would be expected under the **1994 CP** scenario.

Table 1 shows new residential construction for the period 1991-99.

Appendix E. Table 1. New Rural Residential Construction, Madison County. 1991-99											
Township	1991	1992	1993	1994	1995	1996	1997	1998	1999	total	Annual Average
Canaan	9	20	17	21	16	21	12	14	13	143	15.9
Darby	2	7	6	9	3	5	3	5	4	44	4.9
Deer Creek	4	4	2	5	3	2	3	5	0	28	3.1
Monroe	8	9	8	12	14	14	8	6	5	84	9.3
Pike	0	0	2	1	1	2	1	3	4	14	1.6
Somerford	12	47	40	21	15	15	15	15	12	192	21.3
Jefferson	8	14	17	16	13	9	14	10	15	116	12.9
Total	**43**	**101**	**109**	**85**	**65**	**68**	**56**	**58**	**53**	**621**	**69**

source: Madison County 2000

Note: The construction numbers shown above do not include new residential construction in incorporated towns and villages which would make these numbers significantly higher.

Tables 2 and 3 use information from the above table to calculate the number of houses which can reasonably be expected to be built by 2030 given that future construction occurs at a rate similar to the period 1991-99.

Appendix E. Table 2. Impact Estimates of Madison County Farmland Preservation Plan on Residential Development in Alternative 2 VPA							
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
Township	Total assessed acres	Township acres in VPA	Percentage of total assessed acres in VPA *(2) / (1)*	VPA acres as % of total VPA acres	Average annual residence construction 1991-99	Total houses constructed 2030 30 * *(5)*	VPA proportional housing # *(6) * (3)*
Canaan	22,142	278	1.3 %	1.4 %	15.9	477	6.2
Darby	11,336	1,010	8.9 %	5.0 %	4.9	147	13.1
Deer Creek	15,502	2,734	17.6 %	13.5 %	3.1	93	16.4
Monroe	14,563	10,357	71.1 %	51.1 %	9.3	279	198.4
Pike	16,561	4,011	24.2 %	19.8 %	1.6	48	11.6
Somerford	12,204	1,891	15.5 %	9.3 %	21.3	639	99.0
Totals	92,308	20,281	22.0 %	100.0 %	56.1	1,683	344.7

source: col. 1. Madison County Auditor's Office, 2000. col. 5 Appendix D, Table 1.

Assume that new construction in the VPA will occur in the same proportion as current township acres in the VPA.

Assuming two acres per residence, 345 residences can be expected to be built by 2030 covering 690 acres. This 690 acres will be used to estimate regional economic impacts for the Farmland Preservation Plan scenario for the VPA.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Township	Total assessed acres	Township acres in WCA	Percentage of total assessed acres in WCA (2) / (1)	WCA acres as % of total WCA acres	Average annual residence construction 1991-99	Total houses constructed 2030 30 * (5)	WCA proportional housing # (6) * (3)
Canaan	22,142	667	3.0 %	2.9 %	15.9	477	14.3
Darby	11,336	833	7.3 %	3.6 %	4.9	147	10.7
Deer Creek	15,502	1,063	6.9 %	4.6 %	3.1	93	6.4
Monroe	14,563	3,749	25.7 %	16.1 %	9.3	279	71.7
Pike	16,561	12,584	76.0 %	54.1 %	1.6	48	36.5
Somerford	12,204	2,200	18.0 %	9.5 %	21.3	639	115.0
Jefferson	22,886	2,162	9.4	9.3	13	387	36.4
Totals	**115,194**	**23,258**	**20.2 %**	**100.0 %**	**69**	**2,070.0**	**291.0**

Appendix E. Table 3. Impact Estimates of Madison County Farmland Preservation Plan on Residential Development in Alternative 2 WCA

source: col. 1 Madison County Auditor's Office, 2000. col. 5 Appendix D, Table 1.

Assume that new construction in the WCA will be in the same proportion as the current township acres in the WCA.

Assuming two acres per residence, 291 residences can be expected to be built by 2030 covering 582 acres.

These 582 acres will be used to estimate regional economic impacts for the Farmland Preservation Plan (**FPP)** scenario for the WCA